Impact of Sault Ste. Marie East End Wastewater Treatment Plant Discharge on Lake George Channel (St. Marys River) Waters

April 2000



Ministry of the Environment

# Impact of Sault Ste. Marie East End Wastewater Treatment Plant Discharge on Lake George Channel (St. Marys River) Waters

Prepared by: P. B. Kauss

Ontario Ministry of the Environment
Environmental Monitoring and Reporting Branch
Surface Water Section
125 Resources Road
Etobicoke, Ontario M9P 3V6

and

P. C. Nettleton
Ontario Ministry of the Environment
Environmental Monitoring and Reporting Branch
Environmental Modeling and Emissions Inventory Section
2 St. Clair Avenue West
Toronto, Ontario M4V 1L5

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### **EXECUTIVE SUMMARY**

This report provides a summary and assessment of data obtained during the 1989 Ontario Ministry of the Environment Sault Ste. Marie East End Wastewater Treatment Plant (WWTP) evaluation surveys. It includes a discussion and interpretation of the WWTP discharge and its impact on Lake George Channel receiving waters. Data included in this document cover the plant final effluent and river water quality monitoring conducted during the June and August surveys. Also included is flow, river current and plume tracking data, as well as bacterial densities and contaminant concentrations in surficial sediment samples collected during the second survey. Major findings and conclusions include:

- (i) The discharge area for the WWTP is on a shallow shelf of less than 2 m depth, where currents are quite variable but typically less than 10 cm.sec<sup>-1</sup>, with variable direction of flow. Because of the shallowness, flow in the discharge area is more susceptible to influence by wind than the deeper, faster flowing waters of the main channel. For example, under northeast wind conditions, the direction of travel of drogues was initially perpendicular to shore, progressing to about 45 degrees relative to the shore for the first 200 m of travel. This can cause the WWTP discharge plume to impinge on U.S. waters (i.e., result in trans-boundary pollution).
- (ii) The impact of the WWTP discharge on Lake George Channel water quality did not differ appreciably from earlier studies. During the six days of sampling during the two surveys, the East End WWTP design capacity was exceeded once, during a period of high rainfall on August 22<sup>nd</sup>. Plant discharge loadings were greatest for all measured parameters (suspended solids, chloride, bacteria (faecal coliforms, *Escherichia coli*, *Pseudomonas aeruginosa*), ammonium, total Kjeldahl nitrogen, total phosphorus, phenolics, iron and zinc) on August 22<sup>nd</sup>, due to the high discharge rate and elevated levels in the final effluent. On this day, estimated loadings of faecal coliforms were up to 200 times greater, while suspended solids, ammonia, total Kjeldahl nitrogen, total phosphorus, iron and zinc loadings were up to two times greater than on the day with the lowest loading.

The impact of the WWTP discharge on Lake George Channel water quality was evident from data on faecal coliforms, *E. coli*, *Pseudomonas aeruginosa* conductivity, chloride, ammonia, total Kjeldahl nitrogen, total phosphorus, phenolics, iron and zinc, levels of which increased noticeably downstream of the discharge point during both surveys. The greatest effect on bacteria densities in river water was found on August 22<sup>nd</sup> and 23<sup>rd</sup>, during and immediately following the period of heavy rainfall. For example, faecal coliform densities exceeded the PWQO for the protection of recreational users as far as 4.7 km downstream (i.e., at Bell Point). (*E. coli* accounted for 42% to 85% of the fecal coliforms in the final effluent.) Total phosphorus exceeded the PWQO to prevent excessive aquatic plant growth in rivers for a distance of up to 0.9 km downstream of the

discharge point. Phenolics concentrations exceeded the PWQO to prevent tainting of fish at upstream as well as downstream locations, indicating the influence of sources located upriver of the WWTP.

(iii) Surficial sediments collected at 16 locations in Lake George Channel and in Little Lake George were generally very organic or "oozy" in nature, had an oily sheen, and often with a sewage or oily odour. Sediments from up to 2 km downstream of the WWTP discharge contained elevated (above upstream samples) densities of faecal coliform, Escherichia coli and faecal Streptococcus bacteria. Densities of these organisms reached as high as about 134,000, 14,400 and 21,000 organisms per kg of wet sediment. Concentrations of nutrients and persistent inorganic contaminants (e.g., heavy metals) usually increased downstream of the WWTP discharge, and concentrations were often higher at inshore stations than at offshore stations. Statistical analysis indicated that concentrations of arsenic, cyanide, heavy metals and many of the individual PAH compounds correlated significantly with one another, suggesting a common source. Concentrations of many of the contaminants in Lake George Channel and Little Lake George sediments, as well as at the upstream reference (i.e, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc, total PAHs and of 11 individual PAHs), exceeded the Lowest Effect Level Provincial Sediment Quality Guidelines for the protection of benthic organisms. This indicates that upstream sources contribute or have contributed to sediment quality problems in the Lake George Channel and in Little Lake George. In addition, concentrations of available cyanide at some stations exceeded the Provincial guideline for Open Water Dredged Material Disposal. Iron also exceeded the Provincial "Severe Effect Level" (SEL) sediment quality guideline at some stations. Total phosphorus only exceeded the PSQG-LEL at some stations downstream of the WWTP, but total Kjeldahl nitrogen exceed the PSQG-LEL on all but one transect.

Concentrations of solvent extractables exceeded the Provincial Open Water Dredged Material Disposal Guideline of 1,500 mg.kg<sup>-1</sup> at stations on downstream transects, as well as at the upstream reference stations, which had the highest concentration. This suggests a dominating influence from upstream sources.

A draft version of this document was provided to the Sault Ste. Marie District office staff and St. Marys River Remedial Action Plan coordinator in September, 1995

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#### 1.0 INTRODUCTION AND BACKGROUND

#### 1.1 Status of Sault Ste. Marie East End WWTP

The Sault Ste. Marie East End Wastewater Treatment Plant (WWTP) is a primary municipal facility with a design capacity of 54.55 x 10<sup>3</sup> m<sup>3</sup>.day<sup>-1</sup> and an average daily flow of 42 x 10<sup>3</sup> m<sup>3</sup>.day<sup>-1</sup>. The discharge alternates between two adjacent 1.67 metre diameter pipes extending 152 m. from shore (Kleinfeldt, 1987) on a relatively shallow (1 to 2 m. depth) shelf in the Lake George Channel (Fig. 1). Combined with the hydrological characteristics of the area (see Section 1.2), this can lead to poor dispersion of the effluent (Fig. 2).

The WWTP was identified by the Upper Great Lakes Connecting Channels Study as an important point source of several contaminants to the St. Marys River (UGLCCS, 1989). These included: phosphorus, ammonia, chloride, oil and grease, certain metals, volatiles, polycyclic aromatic hydrocarbons, chlorinated phenols, chlorinated benzenes and chlorinated ethers as well as bacteria (OMOE, unpubl. 1986-87 data). In addition, the treatment capacity of the plant was frequently exceeded during periods of heavy rainfall (UGLCCS, 1989).

A major plant expansion, including new sludge handling facilities and phosphorus removal equipment, came on-line in April, 1989. Preliminary bench-scale testing indicated that final effluent suspended solids concentrations would be reduced substantially as a result of the phosphorus removal process. It was also anticipated that this would improve the efficiency of year-round chlorination and hence, significantly reduce bacterial levels in the discharge.

#### 1.2 Water Quality Issues

During three 1986 and 1987 Ontario Ministry of the Environment (OMOE) MISA pilot site surveys, bacterial densities were elevated downstream of the East End WWTP outfall. The geometric mean fecal coliform density exceeded the Provincial Water Quality Objective (PWQO) for body contact recreation of 100 organisms.dl<sup>-1</sup> (UGLCCS,1988) as far away as Bell Point, about 5 km. downstream. During the same surveys, total phosphorus and ammonia concentrations also increased downstream of the WWTP outfall (e.g., Fig. 3). Similar results were observed in a 1988 survey conducted by the Ministry's Northeastern Region: elevated levels of turbidity, suspended solids and phosphorus were found up to 1 km downstream, and fecal coliform densities were above the PWQO for at least 3 km downstream of the discharge (Smith, 1988).

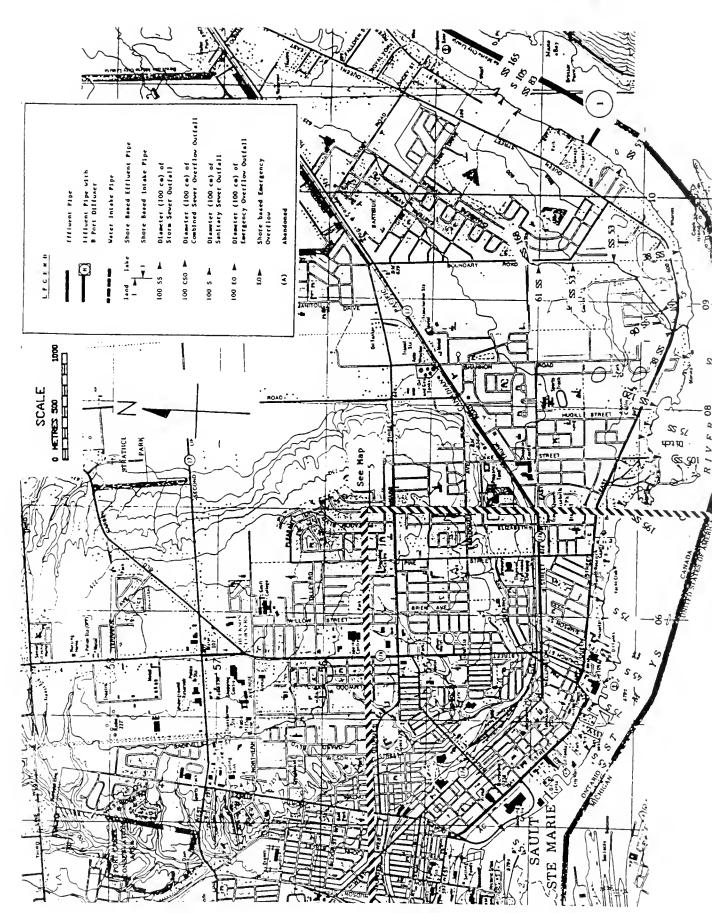


Figure 1. Location of Sault Ste. Marie, Ontario East End WWTP and sewer discharges. (from Kleinfeldt, 1987)

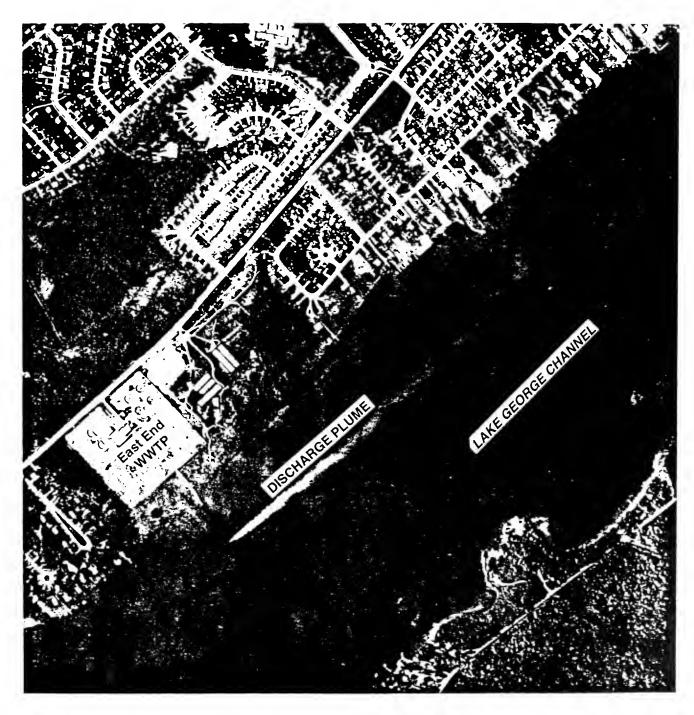


Figure 2. Aerial view of the Sault Ste. Marie East End WWTP discharge plume, June 15, 1984. (Source: Ontario Ministry of Natural Res., Ontario Centre for Remote Sensing).

Previous studies suggest that Canadian and American waters do not mix to an appreciable degree in the upper river or in the main channel above Sugar Island. Nevertheless, some transverse mixing does occur in the Lake George Channel due to the curving nature of the channel. This creates a zone of high velocity towards the Sugar Island (U.S.) shoreline and can lead to transboundary pollution, both from upstream sources as well as from the East End WWTP discharge (UGLCCS, 1989). For example, a 20% increase in ammonia concentrations was detected in U.S. waters of the channel downstream of the WWTP outfall in 1981 (Hamdy & LaHaye, 1983). Transboundary pollution was also detected during 1988 for turbidity, suspended solids, phosphorus and bacteria at distances of from 0.5 km to 3 km downstream of the outfall (Smith, 1988).

During 1988, complaints were received by the Ministry's Sault Ste. Marie district office from downstream waterfront residents regarding floating scum. In the fall of the same year, the end of an outfall pipe broke loose from its moorings and surfaced.

# 1.3 Sediment Quality Issues

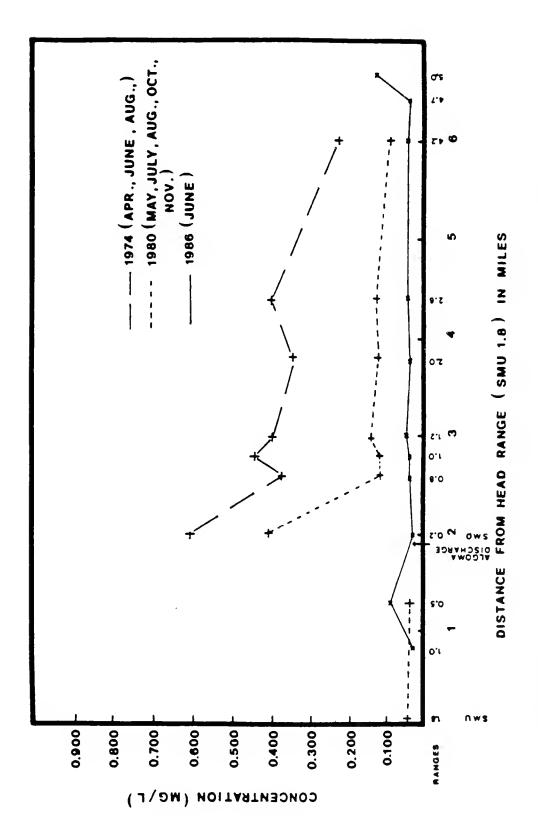
Sediments immediately downstream of the WWTP outfall contain elevated concentrations of contaminants such as heavy metals (e.g., zinc, iron), solvent extractables and polycyclic aromatic hydrocarbons (Kauss, 1986, 1991). In 1985, the benthic macroinvertebrate community in this area was severely to moderately impaired, with an additional zone of moderate impairment extending downstream into Little Lake George as well as upper Lake George (Burt *et al.*, 1988; Fig. 4).

#### 2.0 STUDY OBJECTIVES

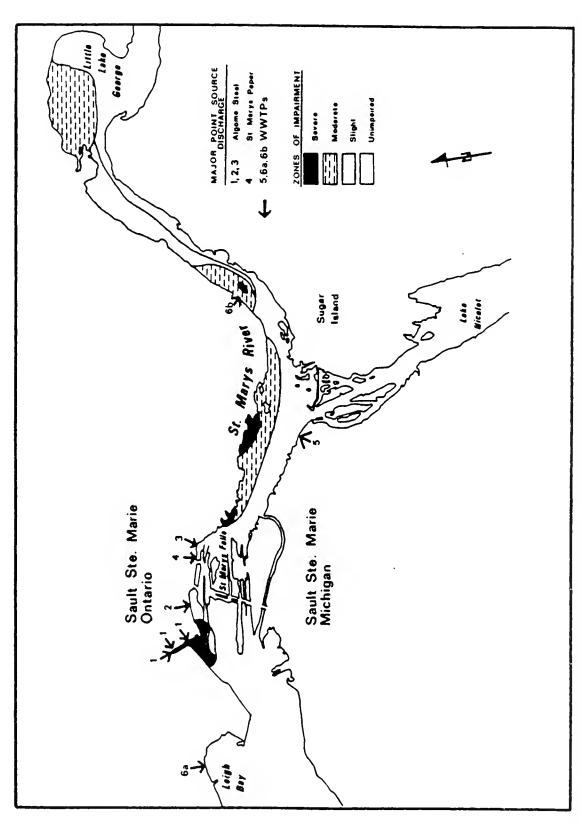
- (i) To determine the current (i.e., post-expansion) impact of the Sault Ste. Marie, Ontario East End WWTP discharge on St. Marys River water and sediment quality in relation to previous years.
- (ii) To determine the variability of the zone of impact of the WWTP discharge plume.
- (iii) To obtain data for the present outfall location (velocities, dispersion coefficients, chemistry) that will aid in modelling and design for a new outfall location/configuration and/or WWTP upgrading.

#### 3.0 FIELD METHODS

Sampling was confined to two periods during 1989: June 27 - July 1 and August 20-24.



Ammonia distribution and yearly trends (1974, 1980 and 1986) along the Sault Ste. Marie, Ontario shoreline. (Source: OMOE data, in UGLCCS, 1989). Figure 3.



Distribution and zones of impairment of benthic macroinvertebrate communities in the St. Marys River, 1985. (Source: UGLCCS, 1989, after Burt et al., 1988). Figure 4.

### 3.1 Physical Measurements

#### 3.1.1 River Current Measurements

River current velocity and direction were measured (usually on the same day as chemistry) at 100 m intervals, starting at 100 m from the Canadian shore, along transects B, D, E, F, G and H (see Fig. 5). Data were collected using Anderaa Model RCM4S recording meters operated from the survey vessel, which was double-anchored (bow and stern).

At shallow stations (i.e., less than 2 m water depth) measurements were obtained at mid-depth only. Stations deeper than 2 m were measured at approximately 0.2 and 0.8 of total water depth. Stations were measured during six different days (three days during each of the two surveys). The period of current measurement was 10 minutes at each station/depth, with readings every 30 seconds.

Temperature and conductivity profiles were also obtained at each station.

#### 3.1.2 Effluent Discharge Rate and Plume Tracking

During the period of river water quality sampling, discharge flow rate and temperature data were obtained for the WWTP final effluent. These measurements were made three times on each of the six survey days and were coincident with effluent chemistry sampling (see Section 3.2.1).

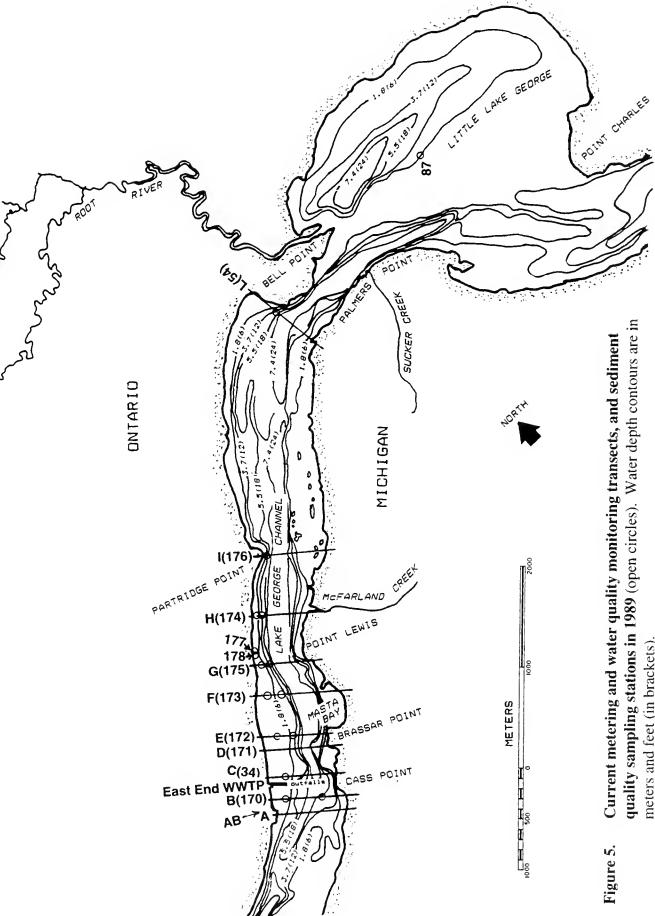
In addition to current measurements, the direction of the effluent plume was determined at the beginning of each survey day to aid in optimization of the river water sampling stations. Two drogues were released at the outfall discharge at mid-depth and tracked for a minimum of 30 minutes.

#### 3.2 Effluent and River Sampling

Grab river water and effluent samples were collected on each survey day, using the appropriate bottles or containers and sample preservation techniques (OMOE, 1989).

# 3.2.1 Effluent Quality

Three grab samples of the WWTP final (treated) effluent were obtained during each of the six survey days using a pole sampler which held the bottles upright. Sampling was designed to coincide with the period of river water quality sampling (usually between 09:00 and 16:00 hours).



quality sampling stations in 1989 (open circles). Water depth contours are in meters and feet (in brackets).

### 3.2.2 River Water Quality

The 37 river water quality sampling stations were located along seven transects shown in Figure 5: B, C, D, E, F, H and L (Stations 170, 34, 171, 172, 173, 174 and 54, respectively). These were not always coincident with the current metering stations, the final locations being decided upon in the field each day, based on the results of effluent drogue tracking (see Section 3.1.2). Station descriptions are provided in Appendix Table A-1.

Grab river water samples were pumped from the desired depth using a March Model 5C MD submersible pump attached to a Teflon® -lined hose system that was cleaned before each day's sampling. Additionally, the system was flushed with sample water from each station/depth prior to taking the sample. Except for those bottles already containing preservatives, sample containers were first rinsed twice with sample water before keeping the sample.

At stations of less than 2 metres depth, a single sample was collected at mid-depth. With the exception of stations noted in Appendix Table A-1, two samples were collected at the deeper stations, one each at 0.2 and 0.8 of water depth.

Duplicate samples were also collected at three selected station depths on each of the six sampling days to provide data on within-station variability.

## 3.2.3 Surficial Sediment Quality

During the second survey, on August 20-22, surficial sediments were collected at 16 stations located mainly in Ontario waters of the Lake George Channel and in Little Lake George (see Fig. 5 and Appendix Table A-1).

A clean, sterilized\* Shipek dredge was used to collect three samples at each station. The top 3 cm (central portion) of each of the replicates was removed with a sterilized\* spoon and then all were composited and homogenized in a clean, sterilized\* stainless steel pan.

After a known volume of sediment homogenate had been weighed to obtain the field (wet) weight, the remaining sediment was distributed among the required sample jars/containers and preserved as required (OMOE, 1989). Pre-sterilized (i.e., autoclaved) jars were used for bacterial submissions.

To provide data on within-station variability (e.g., heterogeneity) two additional replicate samples were obtained at two selected stations.

<sup>\*</sup> allowed to soak in alcohol between stations.

## 3.3 Field Quality Assurance

#### 3.3.1 Effluent

Once during each of the two surveys, a split sample randomly selected from all nine possible samples/times, was submitted for all chemical and bacteriological tests to provide data on sample handling, preservation and transport, and on laboratory reproducibility.

#### 3.3.2 River Water

During each of the six survey days, three split samples, randomly selected from all 37 possible stations/depths, were submitted for all chemical and bacteriological analyses. In addition, one "field blank" was obtained each day by pouring distilled water through the pump-hose sampling system and submitted for chemical analyses (not bacterial) only, to provide information on potential station-to-station cross-contamination.

Finally, for each of the two surveys, one distilled water "travel-blank" was obtained by filling the required bottles for chemical analyses at the Etobicoke laboratory and transporting them to the field and back to obtain information on potential background (container) contributions to observed measurements.

# 3.3.3 Surficial Sediment

At two stations randomly selected from the 14 sampled, enough sediment was collected to permit the submission of blind duplicate (split) samples for all analyses.

#### 4.0 ANALYTICAL METHODS

All effluent, river water and sediment samples were submitted to the Ministry's Etobicoke Laboratory Services Branch and analyzed according to documented procedures (OMOE, 1983 and updates) for the parameters listed in Appendix A, Tables A-2 and A-3. Analytical methods and measurement capabilities are also included in the tables.

Analytical parameter selection was based on those effluent contaminants with the highest above-background (river) concentrations during the 1986/87 MISA pilot study surveys (Appendix Table A-2). Parameter selection was similar for sediments, with the additional objective of filling data gaps for certain contaminants (e.g., bacteria, arsenic, cyanide and polycyclic aromatic hydrocarbons).

#### 5.0 RESULTS AND DISCUSSION

#### 5.1 Physical Measurements

#### 5.1.1 WWTP Discharge Rate

Data on water temperature and flow rate of the East End WWTP final effluent are provided in Table 1. It is noteworthy that the peak flow rate of 60,000 m<sup>3</sup>.d<sup>-1</sup> was recorded during mid-day of August 22. A total 11.2 mm of rainfall was recorded at the Sault Ste. Marie, Ontario airport on this day (Appendix Table A-4).

#### 5.1.2 River Water Temperature and Currents

Depth profile data on water temperature in the Lake George Channel are listed in Tables 2 and 4. These do not indicate any pronounced thermal stratification of the receiving waters during the two surveys.

Over the two survey periods, river current velocities were measured at a total of 26 stations. At 14 of these stations, velocities were measured at two different depths, (using two Anderaa RCM4S meters).

A basic statistical summary (i.e., mean, standard deviation, minimum and maximum) of the measured current velocities is provided in Table 2. This includes the results of measurements made during June 28-29, June 30, July 1, August 22, August 23 and August 24, respectively.

In Table 2, the "current heading" is the bearing angle between the current direction and the "Magnetic North" direction. This angle is positive if it is measured clockwise from North, and negative if it is measured counter-clockwise from North. During 1989, in the St. Marys River area, the "Magnetic North" direction was about seven degrees towards the West of "True (geographic) North". As examples of how the above applies to Table 2: a "current heading" of -128, -38, +52 and +142 degrees, means that the current is flowing towards the geographic SW, NW, NE and SE direction, respectively.

#### 5.1.3 Plume Tracking

Although two drogues were released very near to the outfall location on each of the six days, some difficulties were experienced due to the shallow water conditions in the vicinity of the outfall. As a result, only nine of the 12 total releases provided useful plume tracking information.

The travel paths taken by the nine drogues are indicated in Figures 6 and 7. These Figures summarize results obtained during the six measurement days: June 27, June 28, June 29, August 22, August 23 and August 24, respectively.

Table 1. East End WWTP final effluent flow rate and quality.

Zinc	ug i	- 1	9	2	7	0	-	30	7	09	46	43	64	_	9	62	9	4	-	16	0	-	- 2	2	24	T	7
				3	۳.				en	ō	7	7	7	2	ñ	9	بي.	77	2	Ĭ	Ž	2.	5	2.	2	5	ď
lron	μg.1 <sup>1</sup>	1200	920	710	922	1200	830	800	927	850	:	089	760	770	1200	1200	1035	880	1000	790	886	770	730	720	740	67.0	7/0
Phenolics	µg.11	41.0	0.14	47.0	42.9	48.0	45.0	580	664	51.0	51.0	8 ++	48 8	37.6	1	49.6	43.2	46.0	456	424	977	8,5	37.4	36.3	39.0	711	44.0
Phosphorus Phenolics	mg i'	09.0	99.0	0.64	0.63	0.84	0.84	160	98 0	1.02	08 0	0.64	08.0	0.78	1.30	2.42	1.35	0.85	0 75	0 65	0.75	06.0	92.0	09.0	0.74	0.63	0.03
Kjeldahl Nitrogen	mg.l <sup>-1</sup>	18 00	18 20	23.10	19.63	19.70	20.90	25 20	21.81	21 40	19.80	20.40	20.52	23.60	31.80	30.50	28.39	24.90	24.50	24 70	24 70	23.90	22.30	22.55	22.91	32.83	70.77
Ammonium	mg.1	15.50	15.70	20.02	17.00	17.10	17 80	21.80	18 79	16.40	16.20	17 20	16.59	19 80	24.90	22.40	22.27	19 70	20 00	19.10	19.60	18.80	18.20	18 10	18 46	18 70	10.70
Pseudomonas aeruginosa	number.dl '	1480	<20	~33	-79	300	~117	-328	-226	-30	1600	2900	-737	880	3300	7600	2805	220	099	160	406	~20	320	220	~112	3735	C+C-
Escherichia coli	number di'	52000	1700	33000	14289	41000	1000	3600	8939	920	55000	0006	7694	;	;	1	:	:	;	:	:	1000	2600	1550	1591	8869	00.70
Fecal coliforms	number.dl 1	75000	2300	50000	20508	77000	5300	0009	13516	2200	132000	13000	15571	72000	570000	0000101	346473	4700	35000	5500	10517	1100	4300	2000	2292	18701	0701
Chloride	mg.I <sup>-1</sup>	87.40	91.20	90.80	89.80	87.30	92.10	88.30	89 20	86.10	88.60	90.20	88.28	75.20	71 50	66.50	86.02	68.00	72.20	74.10	71.39	67.50	71.00	65.50	96'.29	79.07	70.71
Conductivity	µmho.cm	730.0	729.0	7520	737 0	738.0	751.0	0.992	7520	736.0	732.0	700 0	722.0	638.0	0.699	653.0	653.0	638.0	643.0	643.0	641.3	636.0	6330	623.0	630.6	687 6	0.750
Suspended Sofids	mg i	21.0	20.7	19.0	20.2	20.3	19.2	21.3	20.2	29.6	21.4	18.2	22 6	21.1	32.0	45.3	31.3	246	31.7	26.2	27.3	31.5	25.3	18.8	246	24.1	
Turbidity	FTU	11.30	9.20	5.70	8.40	10.10	9.90	11.40	10 40	13.40	10.30	9.50	10.94	8.90	13 50	19.00	13.17	9.00	9.00	10.90	65.6	15.20	10.40	8.80	11.16	10.51	
Hd	-log10[H*]	7.46	7.92	8.01	7 85	7 87	7.92	7.92	7 90	7 48	7.52	7.37	7.46	7 16	7 16	7.15	7.16	7.10	7 02	7.51	7.27	7 25	7 25	7.47	7.34	7.59	
Discharge Temperatur pH Turbidity Suspended Rate Solids	o,C	16.0	16.5	16.5	16.3	0 91	160	16.0	16.0	16.0	16.0	16.0	091	20 0	20.0	20 0	200	20.0	20 0	20 0	20.0	20.0	20.0	20.0	20 0	17.9	
Discharge Rate	10°m³ day	38.5	40.0	40.0	39.5	38.0	30.0	30.0	32.5	37.0	30.0	31.0	32.5	36.0	0.09	18.0	47.0	30.0	37.0	37.0	34.5	30.0	35.0	37.0	33.9	36.3	
Sampling time	Date Time	June 27 10:25	11:25	12:35	" теал	June 28	=	:	теал	June 29 09:30		11:30	" теап	Aug 22 11:00	4 12:30	14:00	" mean	Aug. 23 09:00		11:00	" mean	Aug 24 09:00		11:00	" тезп	Study Mean	,

NOTES:

"mean" = "--" =

geometric (log<sub>in</sub>) mean information or data not available (e.g., sample spoiled in laboratory accident) less than

- = approximately
Underlined values in shaded cells, if monthly averages, would exceed the GLWQA monthly average objective of 1 mg/l total phosphorus for sewage treatment plants (IJC, 1988)
Bolded discharge rate exceeds the design capacity

Summary of Lake George Channel current meter and temperature measurements. Table 2.

Science   Challen   Chal	Date	Transact	Distance from CDN Meter Depth m	1	Number of		Temperature, °C	ure, °C			Current Heading, degrees	Ing, degrees			Current Speed, cm.s'	eed, cm.s.4	
Bigging         100         0.5         9.4         0.04         9.3         9.4         9.		(Station)			dings	mean	s.d	min	nax	- 1	p s	mın.	1	теап	s.d	min	тах
Eurization         15         30         91         91         91         91         92         91         92         91         92         93         94         94         94         94         94         94         94         94         94         94         94         94         94         94         94         85         94         85         94         94         86         94         86         94         94         86         94         94         86         94         94         86         94         94         86         94         94         86         94         94         86         94         94         86         94         94         86         94         94         86         94         94         86         94         94         96         86         94         96         96         94         94         96         96         94         94         96         96         94         96         96         96         96         96         96         96         96         96         96         96         96         96         96         96         96         96         96         96	fune 28	B (170)			23	6.4	0 04	9.3	+6	41.9	45.93	57.7	110.4	3.7	3.26	1.5	12.7
Fig.	3	1			30	0.6	0.05	0.6	16	59.2	9.50	78 7	85.6	28.6	5.32	12.7	40.7
E(172) 100 15 2 3 9 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	;			25	0.6	0 04	8.9	0.6	55.3	3.09	50.4	63.6	512	1.86	46.3	618
Fe(T73)	7	;			24	8.9	0.03	6.8	0.6	9.99	3.95	20.0	1.99	40.2	4.64	29.5	46.3
Eurita   Fig. 1	:	;			2.5	0.6	0.03	6.8	9.1	68.2	8.59	47.2	0.98	32.4	4.00	23.9	10.7
E(172)   100   10   18   94   000   94   94   571   1793   249   853   847   859   879	:	;			25	0.6	0.03	0.6	9.1	0.69	8.84	47.6	81.1	29 5	3 23	23.9	35.1
F(172)   100   0.5   17   108   0.11   107   110   107   110   107   110   107   110   107   110   107   110   107   110   107   110   1	:	:			81	9.4	000	9.4	6.4	57.1	17.93	24.9	83.9	8.7	5.97	1.5	18.3
E(I72)         100         0.5         17         108         0.11         107         110         1687         1777         1209         255.2         135         135         35.9           "**         200         "**         21         109         0.01         106         109         2173         85.7         104         30.7         11         220         36.3         36.3         36.3         36.9         36.9         36.9         36.9         36.9         10.9         10.9         10.9         10.9         10.9         10.9         10.9         10.9         21.7         6.46         23.8         4.53         54.5         4.7         5.9         36.9         36.9         36.9         10.9	=	2			20	9.4	0 05	9.4	96	27.8	21 80	-8.1	72.7	3.2	3.18	1.5	12.7
E(172)         100         0.5         111         100         101         101         102         110         102         110         103         111         103         111         103<								t		0		000	0 300	2 (	00 6	9 -	, ,
E(173)         100         11         108         010         100 </th <td>June 28</td> <td>E (172)</td> <td></td> <td></td> <td>17</td> <td>10.8</td> <td>0.81</td> <td>10.7</td> <td>0.11</td> <td>/ 891</td> <td>31.11</td> <td>6 071</td> <td>7.55.2</td> <td>c :</td> <td>3.89</td> <td><u>.</u></td> <td>171</td>	June 28	E (172)			17	10.8	0.81	10.7	0.11	/ 891	31.11	6 071	7.55.2	c :	3.89	<u>.</u>	171
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	=	:			21	8.01	0 11	9.01	10.9	205.7	104 1	20.3	327.3	7.1	5.29	<u>~</u> :	5.3
F(173)         100         24         0.04         9.3         9.5         49.8         2.58         2.58         24.7         2.47         2.49         2.58         2.58         2.47         2.	=	;			21	6.01	90 0	8.01	0.11	217.3	86.55	33.6	336.9	3.6	3.29	5.	12.7
F(173)         100         19         9.3         0.06         9.4         9.5         4.7         6.46         8.3         5.52         3.46         3.46           """"         """         """"         """" <th< th=""><td>=</td><td>;</td><td></td><td></td><td>54</td><td>6.4</td><td>0.04</td><td>6.3</td><td>9.5</td><td>498</td><td>2.58</td><td>42.3</td><td>54.5</td><td>47.7</td><td>2.47</td><td>163</td><td>51.9</td></th<>	=	;			54	6.4	0.04	6.3	9.5	498	2.58	42.3	54.5	47.7	2.47	163	51.9
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	:	;			19	9.3	90 0	9.3	5.6	42.7	6.46	33.3	55.2	29.8	3.46	23.9	35.1
F(77)         100         0.5         18         9.5         0.05         9.4         9.5         4.23         14.26         14.1         62.9         211         9.8           F(77)         100         0.5         2.1         11.7         0.30         11.2         12.2         35.79         38.1         20.0         16.7           "         2.00         1.0         1.0         1.0         1.0         1.0         1.1         0.30         1.1         1.1         0.1         1.1	3	2			26	8.6	0.18	6.4	10.1	39.0	8.31	20.3	52.5	33.2	5.24	29.5	46.3
F(173)         100         0.5         21         117         0.30         11.2         12.5         61.8         74.03         -54.7         209.5         20         167           """         300         """         19         9.8         0.12         10.4         11.8         12.1         37.9         38.1         13.7         18.8         12.8           """"""""""""""""""""""""""""""""""""	3	3			81	9.8	0.05	6.4	9.5	42.3	14.26	14.1	67.9	21.1	81 6	1.5	29.5
F(73)         100         0.5         21         11.7         0.30         11.2         12.5         61.8         74.03         -54.7         200.5         20         16.7           "         300         "         10         19         10.8         0.41         10.4         11.8         12.2         35.79         37.6         18.9         18.8         12.8           "         300         "         19         98         0.05         97         99         11.4         1965         -17.9         59.1         18.8         12.8           "         400         2.0         97         0.05         97         99         11.4         1965         -17.9         59.1         15.8         25.2         17.9         59.1         65.2         25.0         17.9         59.1         10.2         17.9         39.4         65.8         16.2         10.2																	
"         200         10         19         108         0.41         104         118         212         3579         38 1         737         18         128           "         300         "         19         98         0.12         97         102         114         1437         290         38 1         737         18         128           "         400         20         97         0.02         97         102         179         364         404         128           "         400         18         98         0.03         98         99         132         29         149         364         404         128           "         400         18         98         0.03         98         99         185         429         364         441         180         138         170           "         10         10         10         10         10         10         10         346         515         441         118         128         230         230         230         230         230         230         230         230         240         230         230         240         441         441 <td>June 29</td> <td>F (173)</td> <td></td> <td></td> <td>21</td> <td>11.7</td> <td>0.30</td> <td>11.2</td> <td>12.5</td> <td>8 19</td> <td>74.03</td> <td>-547</td> <td>209.5</td> <td>5.0</td> <td>1.67</td> <td>1.5</td> <td>7.1</td>	June 29	F (173)			21	11.7	0.30	11.2	12.5	8 19	74.03	-547	209.5	5.0	1.67	1.5	7.1
a         300         a         19         98         012         97         102         114         1437         7290         336         86         312           a         a         a         a         b         a         01         b         b         c <td>:</td> <td></td> <td></td> <td></td> <td>19</td> <td>8.01</td> <td>0.41</td> <td>10.4</td> <td></td> <td>21.2</td> <td>35.79</td> <td>38.1</td> <td>73.7</td> <td>1.8</td> <td>1 28</td> <td>1.5</td> <td>7 1</td>	:				19	8.01	0.41	10.4		21.2	35.79	38.1	73.7	1.8	1 28	1.5	7 1
a         a	;	1			19	8 6	0.12	6.7	10,2	134	14.37	-29.0	33.6	9.8	3 12	1.5	12.7
"         400         20         19         9 8         003         98         99         326         249         364         404         128           "         80         18         98         003         98         99         326         249         364         484         128           "         500         20         19         101         005         100         100         346         518         163         461         128         375           "         500         10         10         005         100         100         346         518         641         289         135         443         481         136         136         136         136         136         136         136         136         136         136         136         137         441         180         136         136         136         136         136         136         136         136         136         137         441         180         136         136         137         441         180         136         136         136         137         441         138         140         136         136         136         136	;	;			20	4.6	0.05	6.4	6.6	11.4	19.65	-17.9	59.1	6.5	2.55	1.5	12.7
G(175)         100         10         9.8         9.8         9.8         202         5.20         13.7         36.1         28.9         375           a         500         2.0         10.1         0.05         10.0         10.2         5.20         13.7         36.1         28.9         375           a         500         2.0         19         10.1         0.05         10.0         10.2         39.4         6.58         16.5         46.2         23.0         20.8           a         1         2.0         10.1         0.05         0.08         9.8         10.1         33.5         6.41         23.8         54.9         13.5         46.2         13.5         46.2         20.8         37.5         49.8         13.5         44.1         18.0         13.5         40.8         13.5         40.9         13.5         44.1         18.0         13.5         40.8         13.5         40.9         13.5         40.9         13.5         40.9         13.5         40.9         13.5         40.9         13.5         40.9         13.5         40.9         13.5         40.9         13.5         40.9         13.0         40.9         13.0         10.0	=	*			61	8 6	0.03	8 6	6.6	326	2.90	24.9	36.4	40.4	1.28	35.1	40.7
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	=	;			18	86	000	8.6	8 6	20.2	5 20	13.7	36.1	28.9	3.75	23.9	35.1
G(175)         100         17         9.9         0.04         9.9         100         34.6         5.15         21.4         44.1         18.0         1.35           G(175)         100         10         22         9.9         0.08         9.8         10.1         33.5         6.41         23.8         54.9         12.7         1.72           "         200         19         9.8         0.03         9.8         10.1         33.3         4.95         25.2         40.9         12.7         1.72           "         200         11.0         22         0.13         10.0         10.0         10.0         10.0         10.0         10.0         25.3         6.41         38.8         59.1         12.7         1.76           "         300         2.0         10.1         10.0         10.0         10.0         10.0         10.0         26.3         6.62         14.1         38.8         17.0         5.55           "         300         2.0         2.0         10.1         0.10         10.0         10.0         10.0         10.0         10.0         10.0         10.0         10.0         10.0         10.0         10.0         10.0	:	;			61	101	0.05	0.01	10.2	39.4	6.58	16.5	46.2	23.0	2 08	18.3	23.9
G(175)         100         10         22         99         0.08         9.8         101         33.5         6.41         23.8         54.9         12.7         1.72           "         3.0         19         9.8         0.03         9.8         9.9         32.3         4.95         25.2         40.9         12.7         1.86           "         200         "         22         0.13         10.0         10.0         10.5         35.2         2.44         31.5         42.3         39.4         2.40           "         200         11.0         21         10.0         10.0         10.0         10.0         26.3         66.2         14.1         38.8         17.0         5.55           "         300         2.0         20         10.2         10.2         10.3         18.9         5.00         8.8         29.1         17.0         5.55           "         300         2.0         20         10.1         0.10         10.2         10.3         10.2         10.2         10.2         10.2         10.2         10.2         10.2         10.2         10.2         10.2         10.2         10.2         10.2         10.2	:	;			17	6.6	0 04	66	10 0	346	5.15	<del>2</del> .4	1.1	18.0	1.35	12.7	18.3
"         "         3.0         19         9.8         6.03         9.8         9.9         32.3         4.95         25.2         40.9         12.7         1.86           "         200         "         22         10.2         0.13         100         10.6         10	finge 29	G (175)			22	6.6	0.08	8.6	101	33.5	6.41	23.8	54.9	12.7	1.72	7 1	18.3
"         200         "         22         102         0.13         100         105         165         2.44         31.5         42.3         39.4         2.40           "         "         11.0         21         100         0.00         10.0         100	:				. 61	8.6	0.03	8.6	6.6	32.3	4.95	25.2	40.9	12.7	1.86	7.1	18.3
"         "         11.0         21         100         000         10.0	1	3			22	10.2	0.13	10 0	10.5	35.2	2.44	31.5	42.3	39.4	2.40	35.1	10.7
H(174) 100	;	:			21	10.0	000	10.0	10.0	26.3	6 62	<del>-</del> +	38.8	17.0	5.55	7.1	23.9
H(174) 100 10 25 101 0.10 9.9 102 519 0.43 50.7 52.5 82 418  H(174) 100 10 25 10.1 0.06 10.1 10.4 39.4 2.35 32.6 44.1 31.7 3.61  H(174) 100 10 25 10.1 0.03 10.1 10.2 38.9 3.32 32.6 44.8 27.9 3.03  H(174) 100 10 25 10.1 10.2 10.2 10.3 18.9 3.32 2.72 44.8 27.9 3.03  H(174) 100 10 10 10 10 10 10 10 10 10 10 10 10	:	:			20	10.3	0.05	10.2	103	681	5.60	8.8	29.1	32.3	3.38	29.5	40 4
H (174) 100 10 25 10.1 0.06 10.1 10.4 39.4 2.35 32.6 44.1 31.7 3.61 1.2 2.00 2.5 2.3 10.1 0.03 10.1 10.2 38.9 3.3.2 32.2 44.8 27.9 3.03 1.2 2.00 2.5 2.3 10.2 0.05 10.1 10.2 52.7 4.78 43.7 64.3 16.0 3.71 1.0 2.0 2.0 2.0 2.0 10.4 0.11 10.2 10.6 9.7 24.05 40.2 38.5 5.8 2.95 1.0 1.0 0.0 1.0 0.0 1.0 10.0 10.0 10.0	;				21	10.1	0.10	6.6	10.2	819	0.43	50.7	52.5	8.2	4 18	1.5	183
"         "         40         25         10.1         0.03         10.1         10.2         38.9         3.32         3.2         44.8         27.9         3.03           "         200         2.5         23         10.2         0.05         10.2         10.3         49.1         24.5         44.1         53.5         33.2         27.2           "         9.5         22         10.2         0.05         10.1         10.2         52.7         4.78         43.7         64.3         16.0         3.71           "         300         20         22         10.4         0.11         10.2         10.6         9.7         24.05         40.2         38.5         5.8         2.95           "         7.0         20         10.0         0.07         9.9         10.1         -6.0         24.37         -48.9         32.2         6.8         2.19           "         400         1.0         20         10.8         0.12         10.5         11.0         -59.9         78.90         -206.         82.8         2.1         1.71	June 29	H (174)			25	10 1	90 0	101	104	39.4	2.35	32.6	1 ##	31.7	3.61	23 9	35.1
"         200         2.5         2.3         10.2         0.05         10.2         10.3         10.3         10.4         441         53.5         33.2         2.72           "         9.5         22         10.2         0.05         10.1         10.2         52.7         4.78         43.7         64.3         16.0         3.71           "         300         20         22         10.4         0.11         10.2         10.6         9.7         24.05         40.2         38.5         5.8         2.95           "         7.0         20         10.0         007         9.9         10.1         -6.0         24.37         -48.9         32.2         6.8         2.19           "         400         10         20         10.8         0.12         10.5         11.0         -59.9         78.90         -206.         82.8         2.1         1.71	;	:			25	10.1	0.03	10.1	10.2	38 9	3.32	32.2	44.8	27.9	3.03	23.9	35.1
"         9.5         22         10.2         0.05         10.1         10.2         52.7         4.78         43.7         64.3         16.0         3.71           "         300         20         22         10.4         0.11         10.2         10.6         9.7         24.05         -40.2         38.5         5.8         2.95           "         7.0         20         10.0         007         9.9         10.1         -6.0         24.37         -48.9         32.2         6.8         2.19           "         400         1.0         20         10.8         0.12         10.5         11.0         -59.9         78.90         -206.         82.8         2.1         1.71	;	:			23	10 2	0.05	10.2	10.3	161	2 45	<del>-</del>	53.5	33.2	2.72	29.5	35.1
300         20         22         10,4         011         10.2         10.6         97         24.05         -40.2         38.5         5.8         2.95           "         7.0         20         10.0         007         99         10.1         -6.0         24.37         -48.9         32.2         6.8         2.19           "         400         10         20         10.8         0.12         10.5         11.0         -59.9         78.90         -206.         82.8         2.1         1.71	7	2			22	10.2	0.05	101	10.2	52.7	4.78	43.7	64.3	0.91	3.71	7.1	23.9
7.0 20 10.0 007 99 10.1 -6.0 24.37 -48.9 32.2 6.8 2.19	:	:			22	10.4	0 11	10.2	9 01	6.7	24 05	-40.2	38.5	5.8	2.95	1.5	12.7
400 10 20 108 0.12 10.5 11.0 599 78.90 -206. 82.8 21 1.71	=	:			20	10.0	0.07	66	10.1	0.9-	24.37	-48.9	32.2	8.9	2.19	1.5	12.7
	:	;			20	8 01	0.12	10.5	11.0	-599	78.90	-206.	82.8	2.1	1.71	<u>~</u>	7.1

Table 2. continued.

Pote	Tenneaut	Distance from CDN Meter Depth m	Meter Denth m	Number of		Temperature, °C	ure, °C			Current Heading, degrees	ing, degrees			Current Speed, cm.s	eed, cm.s.1	
Date	(Station)	shore, m		Readings	mean	s.d.	mın	max	mean	s.d.	mın.	max	mean	s.d.	min.	max
1.00 30	B (170)	100	0.5	27		0.03	8.6	6.6	415	8.63	242	72.3	13.1	1.50	12.7	18.3
		200	1.0	81	96	0.11	9.5	10.0	0.79	1 45	643	9.69	43.8	2 84	40.7	46.3
4.4	:	=	4.0	20	9.5	0.02	5.6	9.6	63.3	6.47	54.5	80.7	31.2	3 66	23.9	35.1
:	;	300	1.0	20	9.4	0.00	9.4	16	703	3.76	63.6	76.2	57.5	2.55	618	63.1
=	:	=	4.0	21	9.4	0.05	9.3	6.4	68.4	4.41	55.6	74	46.3	3.94	40.7	615
:	:	400	1 0	20	9.4	0.02	9.4	9.5	60.1	5.11	0.08	72.7	30.3	2.72	23.9	35.1
:	:	200	0.5	19	7.6	00.0	7.6	6.7	70.0	8.57	472	86.7	17.7	2.55	12.7	23.9
*	:	009	5	61	10.4	0.13	10.2	10.7	37.5	8.20	203	8.65	22.4	4 48	7.1	23.9
										;	,			0		
June 30	E (172)	100	0.5	19	901	0.05	9 01	10.7	31.6	51.86	-63.2	1167	7 +	×.88	<u>ر. ا</u>	1.7.1
:	=	200	:	81	101	0.05	9 01	101	7 77	25.95	2.2	616	10.2	3 42	7.1	18.3
:	=	300	0.1	19	96	800	96	6.6	54.0	2.57	490	28.7	43.1	2.82	40.7	463
	:	:	4.0	20	9.5	0.02	9.5	9.6	46.8	<b>r</b> 69	32.2	9.99	31.7	3.34	29.5	40.4
;	;	700	1.5	61	9.6	800	9.5	9.6	48.5	5.71	343	59.1	42.8	5.62	35.1	51.9
:	:	:	6.5	21	5.6	90'0	9.5	6.7	37.1	12 00	15.8	612	292	6 22	18.3	40.7
:	:	200	2.0	61	10.0	0 19	4.6	10.2	32.6	21.36	-16.1	65.7	26.0	3.81	18.3	29.5
*	=	:	8 0	91	8.6	90.0	8.7	66	7.77	16 74	16.5	85.6	22.2	3.33	12.7	23.9
		9	4	9	911	000	=	7	1711	51 14	305 5	956	1 6	1.75	1.5	7.1
June 30	F (17.5)	001	C.U	6	0.1	700	7.1	0 !	7.7.7.						i ka	10.3
	=	200	0.1	17	6 01	0 14	8.01	· -	16.0	14.69	/ 14-	1,99,4	8 6	, t	C. 6	10.5
	:	300	=	23	66	0.03	6.6	0.01	39.8	21 04	5.0	8.79	27.3	5.25	5.8	1 05
:	:	400	3.0	81	9.6	90 0	96	86	47.5	151	38.8	55.6	36.7	6.54	23.9	46.3
:	:	:	10.0	20	9.5	0 04	9.5	9.6	34.0	13.64	9 1	58 4	23.3	8.06	7.1	35.1
:	*	200	1.5	20	10.0	90.0	66	10.1	386	39 22	-48 6	6 7 6	13.8	5.60	7.1	23.9
9.	=	:	6.5	20	66	90.0	8 6	10.0	1.91	44.77	-19.3	129 2	11.3	4.73	5:	18.3
_									,				٠	Ċ.	9 -	, 0,
June 30	G(175)	001	1.0	20	10.0	0.14	8.6	10.2	7 !	56.94	-151.	80.3	1.7	5.30	C.1	
:	:	=	0 +	9	8.6	0.07	6.7	66	37.2	21.78	0.5.1	505	8.7	0 1	C. 1	1.2.7
:	:	200	3.0	21	10.2	0.25	8.6	10.7	39.4	7.79	27.3	52.8	396	6.74	29.5	51.9
:	:	3	110	81	6.4	2.10	6.7	9.01	32.9	10.51	20 0	47.2	38.8	9.14	29.5	40.3
:	:	300	2.0	20	10.0	0.07	6.6	10.1	20.4	26.33	-16.1	75.5	29.5	5.99	127	40.7
=	:	=	8 0	21	0.01	80.0	6.6	101	23.2	39.35	-29.7	0.101	21.2	6.26	12.7	35.1
Juna 30	H (174)	901	· -	1,0	00	0.07	47	66	42.5	10 62	20.3	8.09	35.9	2.00	35.1	40.7
or aller	(r / r ) ::	2 :			0.7	0.06	96	80	40.5	17.95	79-	67.5	29.2	6.55	12.7	35.1
=	:	200	3.0	000	6.6	0.05	6.6	0.01	49.8	13.73	210	75.5	35.7	7 00	29.5	40.7
£	:	2 2	10.0	20	9.7	0.05	6.7	8.6	54.4	17 95	214	98.5	32.9	4 20	23.9	40.7
÷	:	300	1.5	61	10.4	0 08	10.2	5 01	-12.7	66.70	-86 3	110.7	7.1	3.70	1.5	12.7
:	;	3	6.5	19	6.6	0.04	8.6	0.01	45.5	21 68	-67.8	163.8	7.1	1.54	1.5	12.7
:	:	400	1.0	21	9.01	0.14	10.3	6.01	164.0	106.8	8.5	320.8	8 -	1.21	1.5	7.1

Table 2. continued.

76, m m Readings 18   15   18   18   18   15   18   18	Date	Transect	Distance from	Meter Depth,	Number of		Temperature, °C	ure, °C			Current Heading, degrees	ing. degrees			Current S	Current Speed, cm.s.	
Helphon   15		(Station)	CDN. shore, m	E	Readings	теап	s.d.	шш	max.	mean	p.s	min.	max	mean	p s	mıa.	тах.
1,	July 1	B (170)	100		18	110	60 0	6 01	11.3	48.7	3.49	43.4	995	=	2.58	7.1	12.7
February	;	:	200	1.5	18	110	0.03	10.9	=	61.6	2.22	57.0	64.3	357	1.81	35.1	40.7
February	:	Ξ	2	5.0	19	10 9	0.03	6.01	110	57.1	3.94	49.7	643	29.5	3.23	23.9	35.1
F(175)   100   10   10   11   11   11   11	:	:	300	1.5	2.1	11.0	0.05	011	=	1 89	2.82	587	720	415	4.44	29.5	46.3
Fe(172)	:	3	5	5.0	20	110	00 0	11.0	110	67.5	5.04	6 55	776	29.2	4 25	23.9	35.1
50         10         10         11         0.00         111         113         69         156         109         371            600         10         19         112         0.00         11         113         66         540         357         570            600         10         16         112         0.06         111         113         466         540         357         570             30         10         16         117         0.06         111         113         466         540         357         574         107            200          19         112         0.06         111         113         466         540         357         514         108         57         514         108         517         518         519         511 </th <th>:</th> <th>:</th> <th>400</th> <th>5.1</th> <th>22</th> <th></th> <th>00 0</th> <th>_ </th> <th>1 1</th> <th>0 † 9</th> <th>6.14</th> <th>47.9</th> <th>73.4</th> <th>21.9</th> <th>3.25</th> <th>18.3</th> <th>29.5</th>	:	:	400	5.1	22		00 0	_ 	1 1	0 † 9	6.14	47.9	73.4	21.9	3.25	18.3	29.5
E(172)	=	£	4	5.0	20		000	=	==	62.1	9.24	504	80.7	77	3.09	1.5	12.7
E(172)   100   10   10   11   11   11   11	=	=	500	0 1	19	11.2	0.03	11.2	E 11	6.08	15 66	10.9	72.3	8.0	3.37	1.5	12.7
E(172)   100   0.5   2.1   11.1   0.00   11.1   11.1   40.2   5.21   30.8   50.0	:	:	009	0 1	16	=	90.0	11	Ε.Ξ	46.6	5.40	357	57.0	12.4	1 40	7 1	12.7
F(172)   100   0.5   21   117   0.06   116   118   32.8   36.52   22.24   102.7	:	Ξ	:	3.0	19	=	000	=	Ξ	40.2	5.21	30.8	20.0	11.2	3.15	7.1	18.3
""         200         ""         19         115         0.05         114         115         666         1743         476         1089           """         300         10         18         112         0.08         112         115         53.8         188         514         580           """         400         20         19         112         0.04         111         112         492         401         381         584           """         400         19         112         0.04         111         112         492         401         381         584           """         500         15         111         0.04         112         102         401         381         584	July 1	E (172)	100	0.5	21	117	90 0	116	8 =	32.8	36.52	-22.4	102 7	5.1	00 0	1.5	1.5
"""         300         10         18         112         008         112         115         118         114         584         188         514         580           """"         400         10         11         100         111         112         492         401         381         584           """         400         15         11         002         111         112         492         401         381         584           """         500         15         18         112         004         111         112         492         401         381         584           """         500         15         18         112         004         112         113         103         492         492         491         487           """         300         10         11         112         004         112         113         103         114         487         287         487         487           """         300         10         112         008         112         113         491         422         437         437           """         300         10         113         013	-		200	:	61		0.05	<del>+</del> =	11.5	9 99	17.43	476	6'301	5.9	2.33	. 5	7.1
Fe(173)   100   20   19   111   000   111   111   533   296   486   591   584   58	=	:	300	1.0	81		80 0	11.2	11.5	54.8	88	514	58.0	292	1.31	23.9	29.5
February   The color	:	:	*	4.0	61		00 0	= 1		53.3	2.96	48 6	59.1	23.9	1.86	18.3	29.5
"""         """         90         11         002         111         112         113         113         114         856         144         856         144         856         144         856         144         856         144         856         144         856         144         856         144         856         144         856         144         856         144         856         144         866         145         144         866         145         147	:	:	400	2.0	61	11.2	0.04	=	11.2	49.2	4 0 1	38.1	58.4	357	4.50	23.9	40.7
F(173)   100   15   18   112   1004   112   113   1035   30.11   319   1428     F(173)   100   0.5   2.0   12.7   0.00   11.2   11.2   11.3   197.2   4761   996   346.7     F(173)   100   0.6   2.0   12.7   0.00   11.2   11.3   44.9   28.55   6.36   150.2     F(173)   100   1.0   18   11.3   0.07   11.3   11.5   47.2   301   42.3   52.8     F(173)   100   2.0   16   11.3   0.07   11.2   11.3   46.4   4.27   301   42.3   52.8     F(173)   100   1.0   1.0   1.1   1.1   1.1   1.1   1.1   1.1   1.1   1.1   1.1   1.1   1.1     F(174)   100   1.0   1.0   1.1   1.1   1.1   1.1   1.1   1.1   1.1   1.1   1.1   1.1     F(174)   100   1.0   1.0   1.1   1.	:	÷		0.6	20	Ξ	0 02	=	11.2	42.1	6.87	14.8	55.6	27.0	4 64	18.3	35.1
F(173)   100   05   20   112   000   112   112   117   176   996   3467     F(173)   100   05   20   127   005   126   128   2576   1512   2179   2873     F(173)   100   05   20   112   008   119   121   87.9   25.55   636   1502     F(173)   100   10   18   11.5   0.06   11.5   11.7   44.9   28.02   15.5   143.5     F(173)   100   20   10   11.3   0.04   11.3   11.4   506   12.72   301   4.23     F(175)   100   10   10   11.3   0.04   11.3   11.4   506   12.72   200   685     F(175)   100   10   19   11.2   0.08   11.2   11.5   11.5   33.8   17.30   74   60.8     F(175)   100   10   19   11.2   0.08   11.2   11.5   11.5   33.8   17.30   74   60.8     F(175)   100   10   19   11.2   0.08   11.2   11.5   11.5   33.8   17.30   33.2   32.1     F(174)   100   10   19   11.4   0.05   11.2   11.5   11.5   37.0   5.00   28.4   46.5     F(175)   100   10   19   11.4   0.06   11.3   11.5   37.0   5.00   28.4   46.5     F(175)   100   1.0   1.0   11.4   0.05   11.5   11.5   37.0   5.00   28.4   46.5     F(175)   100   1.0   1.1   0.05   11.4   11.5   37.0   5.00   28.4   46.5     F(175)   100   1.0   1.1   0.05   11.4   11.5   31.5   14.86   10.9   71.8     F(175)   100   1.1   11.4   11.5   31.5   14.86   10.9   71.8     F(175)   100   1.1   11.4   11.5   11.5   11.5   11.5   11.5     F(175)   11.4   11.5   11.5   11.5   11.5   11.5   11.5     F(175)   11.5   11.4   11.5   11.5   11.5   11.5   11.5   11.5     F(175)   11.5   11.5   11.5   11.5   11.5   11.5   11.5   11.5     F(175)   11.5   11.5   11.5   11.5   11.5   11.5   11.5   11.5     F(175)   11.5   1	=	=	200	1.5	81		0.04	11.2	Н.3	103.5	30.11	31.9	1428	2.1	1.79	1.5	7.1
F(173)   100   05   20   127   005   126   128   2576   1512   2179   2873   130   200   "   19   11.9   008   119   121   87.9   25.55   636   1502   143.5	=		:	5.5	61		000	11.2	11.2	197.2	17-61	9-66	3467	1.5	00.0	1.5	1.5
"         200         "         19         11.9         0.08         119         121         87.9         25.55         636         150.2           "         400         10         18         115         0.06         115         117         449         28.02         155         1435           "         400         20         16         11.2         0.07         11.2         11.5         44.4         4.27         39.2         15.8           "         400         20         17         11.4         0.05         11.2         11.5         46.4         4.27         39.2         52.8           "         500         20         17         11.4         0.05         11.2         11.5         46.4         4.27         39.2         52.8         18.5         68.8         18.5         68.8         18.5         68.8         18.5         68.8         18.5         68.8         18.5         68.8         18.7         46.6         5.68         18.7         68.8         18.4         46.6         5.68         18.7         68.8         18.7         18.7         18.7         18.7         18.7         18.7         18.7         18.7         18.7	July 1	F(173)	100	0.5	20		0.05	12.6	12.8	257 6	15.12	217 9	287.3	<u>*</u>	1.24	1.5	7.1
"         300         10         18         11.5         0.06         11.5         11.7         44.9         28.02         15.5         143.5           "         400         2.0         16         11.3         0.07         11.2         11.5         47.2         30.1         42.3         52.8           "         400         2.0         17         11.4         0.02         11.2         11.5         46.4         4.27         30.1         42.3         52.8           "         500         2.0         17         11.4         0.05         11.2         11.5         46.6         5.68         38.1         52.8           "         500         10         19         11.2         0.08         11.2         11.4         50.6         12.72         20.0         68.5           "         200         3.5         19         11.2         0.08         11.2         11.4         27.8         5.44         19.0         68.5           "         200         3.0         19         11.3         0.05         11.2         11.4         27.8         5.44         19.0         42.7           "         20         19         11.3	. :		200	=	61	6.11	0 08	611	12.1	87.9	25.55	636	150.2	8.1	1.27	1.5	7.1
"         400         20         16         11.3         007         11.2         11.5         47.2         301         42.3         52.8           "         500         20         11.2         00.2         11.2         11.3         46.4         4.27         30.1         45.8         52.8           "         500         20         17         11.4         00.5         11.2         11.4         50.6         12.72         20.0         68.5           "         200         10         11.2         0.08         11.2         11.4         50.6         12.72         20.0         68.5           "         200         3.5         19         11.2         0.08         11.2         11.4         50.6         12.72         20.0         68.5           "         200         3.0         19         11.2         0.05         11.2         11.4         27.8         21.4         19.0         42.7           "         1.0         19         11.2         0.05         11.2         11.4         27.8         51.4         19.0         42.7           "         2.0         19         11.2         0.05         11.2         11.4 <td>-</td> <td>:</td> <td>300</td> <td>1.0</td> <td>18</td> <td>11.5</td> <td>90 0</td> <td>11.5</td> <td>11.7</td> <td>44.9</td> <td>28.02</td> <td>15.5</td> <td>143.5</td> <td>7.1</td> <td>1.91</td> <td>1.5</td> <td>12.7</td>	-	:	300	1.0	18	11.5	90 0	11.5	11.7	44.9	28.02	15.5	143.5	7.1	1.91	1.5	12.7
"         90         20         112         002         112         113         464         427         392         52.8           "         500         20         17         114         005         113         115         466         568         381         55.8           "         500         20         17         114         005         112         115         114         506         12.72         200         685           "         200         3.5         19         112         008         112         114         36         21.24         29         675           "         200         30         19         112         008         112         114         36         21.24         29         675           "         200         19         112         003         112         114         36         344         190         427           "         300         20         113         016         113         114         115         314         115         32.1         32.1         34.2         32.1           "         "         40         11         114         115         114	:		400	2.0	91	11.3	0 07	11.2	11.5	47.2	3.01	42.3	52.8	32.7	3.48	23.9	35.1
"         500         20         17         11.4         0.05         11.3         11.5         46.6         5.68         38.1         55.6           "         70         19         11.2         0.04         11.3         11.4         50.6         12.72         20.0         68.5           "         3.5         19         11.2         0.08         11.2         11.5         33.8         17.30         74         60.8           "         200         3.0         19         11.2         0.08         11.2         11.4         27.8         5.44         190         42.7           "         200         3.0         19         11.2         0.03         11.2         11.4         27.8         5.44         190         42.7           "         200         2.0         19         11.2         0.03         11.4         11.5         61         34.6         10.71         16.2         58.4           "         300         2.0         11.5         0.03         11.4         11.5         14.7         59.7         33.2         92.2           "         4.0         2.0         11.4         0.05         11.3         11.4	=	:	=	0.6	20	11.2	0.02	11.2	11.3	16.4	4.27	39.2	52.8	24.5	3.57	18.3	29.5
G(175)   100   10   11   112   100   114   506   12.72   200   685     G(175)   100   10   10   112   1008   112   115   338   17.30   74   608     G(175)   100   10   112   112   114   278   5.44   190   427     G(175)   100   10   19   11.2   1008   11.2   11.4   278   5.44   190   427     G(175)   100   10   19   11.2   10.3   11.4   11.5   11.4   11.5     G(175)   100   10   10   11.4   10.6   11.3   11.4   11.5     G(175)   100   10   10   11.4   10.6   11.3   11.4   11.5     G(175)   100   10   10   11.4   10.6   11.3   11.5     G(175)   11.3   11.4   11.5   11.5     G(175)   11.5   11.4   11.5   11.5     G(175)   11.5   11.5   11.5   11.5     G(175)   11.5   11.5   11.5   11.5     G(175)   11.5   11.5   11.5     G(175)   11.5   11.5   11.5     G(175)   11.5   11.5   11.5     G(175)   11.5	=		200	2.0	17	11.4	0.05	11.3	11.5	466	5.68	38.1	556	24.9	4 03	18.3	29.5
G(175)   100   10   19   112   008   112   115   388   17.30   74   608   675   67	:	:	=	7 0	61	11.3	0 04	11.3	7 =	9 09	12.72	20.0	68.5	651	2.82	12.7	183
11	July 1	G (175)	100	1.0	61	11 2	80 0	11.2	11.5	33.8	17.30	7.4	8 09	11.2	2.52	7 1	12.7
"         200         30         19         11.3         0.05         11.2         11.4         27.8         5.44         190         42.7           "         110         19         112         0.03         11.2         11.3         61         38.12         -47.9         89.1           "         20         20         19         11.5         0.03         11.4         11.5         61         38.12         -47.9         89.1           1         10         19         11.4         0.05         11.3         11.4         32.1         39.27         -33.2         92.2           1         10         19         11.4         0.06         11.3         11.5         261         36.47         -59.1         86.7           "         200         25         21         11.5         0.04         11.4         11.6         45.8         11.38         7.4         69.9           "         100         21         11.4         0.04         11.4         11.5         51.5         14.86         10.9         77.9           "         200         25         21         11.4         10.5         51.5         14.86         10.9	• •	7	**	3.5	61	11 2	0.05	11.2	7 =	36.5	21 24	5.9	67.5	10.0	2.86	7.1	12.7
H(174)   100   10   112   113   114   115   113   114   115   114   115   114   115   114   115   114   115   114   115   115   114   115   114   115   11	:	:	200	3.0	61	11.3	0.05	11.2	7 =	27 8	5,44	19.0	42.7	30.7	2.33	29.5	35.1
H(174)   100   10   115   0.03   114   11.5   61   38.12   -479   891     H(174)   100   10   19   114   0.05   113   11.5   37.0   5.00   28.4   46.5     H(174)   100   10   19   114   0.06   113   11.5   261   36.47   -591   86.7     U	:	:	;	0 11	61	11.2	0.03	11 2	11.3	34.6	10 71	16.2	58.4	180	4 34	1 1	23.9
H(74)   100   10   19   114   0.05   113   114   32.1   39.27   33.2   92.2     H(74)   100   10   19   114   0.06   113   11.5   37.0   5.00   28.4   46.5     " 200   2.5   2.1   11.5   0.04   114   115   26.1   36.47   5.91   86.7     " 300   1.5   2.1   11.7   0.26   11.4   11.5   51.5   14.86   10.9   77.9     " 300   1.5   2.1   11.7   0.26   11.4   11.5   66.8   73.75   77.8   184.0     " 4.00   10   14   11.5   66.8   73.75   77.8   184.0     " 4.00   10   14   11.7   0.11   11.5   11.5   66.8   73.75   77.8     " 4.00   10   14   17   17   17   17   37.00   33.5   19.5     " 4.00   10   14   17   17   17   17   37.00   33.5     " 5.00   10   14   17   17   17   17   17   17   17	=	:	300	2.0	61	11.5	0.03	17 4	5.11	19	38 12	-479	89.1	9.2	4 98	1.5	18.3
1         H (174)         100         10         19         114         0.06         H 3         115         37.0         5.00         28.4         46.5           "         200         2.5         2.1         11.3         0.05         11.2         11.5         26.1         36.47         -59.1         86.7           "         200         2.5         2.1         11.5         0.04         11.4         11.6         45.8         11.38         7.4         69.9           "         0.0         2.1         11.4         0.0         11.4         11.5         51.5         14.86         10.9         77.9           "         0.0         1.5         2.1         11.7         0.26         11.4         11.5         39.6         73.75         -130.0         138.0           "         0.5         2.1         11.7         0.26         11.4         11.5         66.8         71.87         74.8         184.0           "         4.00         1.0         16         11.7         0.15         11.5         11.5         10.0         13.7         11.3         11.5         11.5         11.87         74.8         1184.0	=	=		0.8	21	7.	0.05	= 3	<del>†</del>	32.1	39.27	-33.2	92.2	9.9	4 28	1.5	12.7
"         40         20         11.3         0.05         11.2         11.5         261         36.47         -59.1         86.7           "         200         25         21         11.5         0.04         11.4         11.6         45.8         11.38         7.4         69.9           "         100         21         11.4         0.04         11.4         11.5         51.5         14.86         10.9         77.9           "         300         1.5         21         11.7         0.26         11.4         11.2         39.6         73.75         -130.0         138.0           "         400         10         14         11.7         0.05         11.3         11.5         66.8         73.75         -130.0         138.0           "         400         10         14         11.7         0.05         11.3         11.5         66.8         73.75         -130.0         138.0	July 1	H (174)	100	0.1	61	7 = 7	90.0	11.3	11.5	37.0	2 00	28.4	46.5	23.3	1.75	18.3	23.9
"         200         25         21         11.5         0.04         11.4         11.6         45.8         11.38         7.4         69.9           "         "         10.0         21         11.4         0.04         11.4         11.5         51.5         14.86         10.9         77.9           "         300         1.5         21         11.7         0.26         11.4         12.2         39.6         73.75         -130.0         138.0           "         4.0         1.3         0.05         11.3         11.5         66.8         73.75         -130.0         134.8         184.0           "         4.0         1.6         13.7         0.13         11.5         11.3         10.0         33.4         11.6	:	:	:	4.0	20	11.3	0.05	11.2	11.5	26.1	36.47	1 65-	86.7	5.4	3 66	1.5	12.7
	z	=	200	2.5	21	1.5	0.04	1 4	116	45.8	11.38	7.4	6 69	27 1	4.52	12.7	35.1
" 300 1.5 21 11.7 0.26 11.4 12.2 39.6 73.75 -130.0 138.0 "	:	;	:	0.01	21	<del>†</del>	0.04	<del>7</del> =	11.5	51.5	14 86	6 01	6.77	212	2 86	18.3	23.9
" " 6.5 21 11.3 0.05 11.3 11.5 66.8 71.87 -74.8 184.0 " " 40.0 10 16 13.7 0.11 11.6 11.9 13.5 11.05	:	:	300	1.5	21	11.7	0.26	7 =	12.2	396	73.75	-1300	138.0	2.0	1.67	1.5	7.1
100 10 15 011 AL	-	2	:	6.5	21	11.3	0.05	11.3	11.5	8.99	71.87	-74.8	1840	2.0	1.67	1.5	7.1
7.71 0.75 0.74			700	1.0	91	117	0.11	911	6.11	17.1	42 00	-33 6	119.5	2.2	1 88	1.5	7.1

Table 2. continued.

Market   M		9	CDN	Motor Donth m	Number of		Temperat	Tre of			Current Head	Current Heading, degrees			Current Si	Current Speed, cm.s.	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Date	(Station)	Distance from CDN.	Meter Deptil, III	Readings	mean	b.e	min.	max.	mean	s d.	min.	тах	mean	s.d.	min	max.
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Angust 22	R (170)	148	1.5	23	16.9	0.02	8.91	16.9	55.0	8.32	33.3	67.1	12.5	8.00	1.5	29.5
B(172)         100         24         167         002         167         168         601         529           1         340         10         24         167         002         167         169         167         169         167         169         167         169         167         169         167         169         167         167         169         167         171         169         169         171         171         172         171         171         171         171         172         171	77 Ke 817 77	(0/1)	252	0.1	23	16.7	90:0	16.7	16.9	62.4	2.09	57.0	66 1	53.1	4.03	40.7	57.5
E((72)         380         10         25         167         006         167         169         671         147	=	3	=	4.0	24	16.7	0.02	16.7	16.8	1 09	5 29	49.3	71.3	47.0	4.37	35.1	51.9
E(72)         30         30         30         10         167         009         167         171         500         2050           E(72)         200         15         21         168         006         167         167         169         172         169         171         172         172         172         172         172         172         173	=	=	180	1.0	25	16.7	90 0	16.7	16.9	63.1	14 27	416	105.9	16.7	7.52	1.5	29.5
E(172) 2,00 0,5 18 172 0,04 171 172 1953 41,07 170 170 170 170 170 170 170 170 170 1	:	=	=	3.0	20	16.7	60.0	16.7	17.1	50.0	20.59	15.8	87.7	5.1	3.20	1.5	12.7
E(172)         300         0.5         18         172         0.04         171         172         171         172         171         172         171         173         171         173         171         173         171         173         171         173         171         173         171         173         171         173         171         173         171         173         171         173<	:	=	909	5.1	21	16.8	90:0	16.7	16.9	0 09	7 85	31.2	716	7 7	2.80	1.5	7.1
E(172)         300         0.7         17.2         0.0         17.2	-	1	Ç.	ų S	0	, 71	0.01	171		195 3	11.07	1383	317 3	1.5	000	1.5	5
Heart   Hear	August 22	E(1/7)	007	60	9 9	7/1	0.04	- 0		. 02	10.14	7.02	00		27.6		7 1
B(170)	=	;	300	1.0	22	17.0	900	16.9		707	4 17	03.0	4.00	÷ ,	2.73		- 1
Heat	:	:	Ξ	3.0	17	16.9	000	16.9	16.9	53.1	27 26	-507	0.17		7 68	5.1	
B(170)         186         167         168         168         453         451           B(170)         1.5         2.3         1.6         0.03         168         168         169         35.8         15.4           B(170)         1.86         1.5         2.3         16.8         0.01         16.8         16.9         35.8         15.4         11.5           B(170)         1.86         1.5         2.0         1.68         0.01         16.8         16.9         35.8         15.4         15.4           B(171)         1.86         1.7         1.68         0.02         16.9         17.0         15.4	=	:	910	1.5	21	16.8	0.04	167	16.8	† 6†	2 60	43.4	542	48.7	2.77	46.3	519
B(170)         186         15         23         168         105         168         169         394         1153           B(170)         186         15         23         168         003         168         169         358         1254           B(170)         186         15         20         168         001         168         669         254         1534           B(170)         186         15         20         168         002         168         669         254         1254           B(170)         186         17         169         170         171         170         171         171         170         171         254         188         189         170         181         187         171         170         171         171         171         171         171         171         171         171         172         188         188         187         250         254         188         190         220         415         250         254         188         190         220         254         188         190         220         254         1150         1171         271         279         241         230	:	=	=	5.0	2.1	16.7	0.03	16.7	16.8	45.3	4.51	33.3	52.1	45.8	1 64	40.7	46.3
B (170)         186         168         168         168         168         169         158         15.4           B (170)         186         17         188         17         606         583         15.4           "         300         "         20         168         001         168         170         606         583           "         400         10         19         169         002         168         170         839         876           "         400         10         19         168         002         169         170         839         876           "         400         10         19         169         002         170         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171         171         170         171         171         170         171         171         171 </td <td>:</td> <td>=</td> <td>525</td> <td>1.5</td> <td>23</td> <td>16.8</td> <td>0.05</td> <td>16.8</td> <td>16.9</td> <td>39.4</td> <td>11.53</td> <td>15.1</td> <td>64.7</td> <td>110</td> <td>5.07</td> <td>7.1</td> <td>23.9</td>	:	=	525	1.5	23	16.8	0.05	16.8	16.9	39.4	11.53	15.1	64.7	110	5.07	7.1	23.9
B (170)         186         0 11         168         0 11         168         0 11         168         0 12         168         0 11         168         172         606         5 83           "         400         10         19         169         002         169         170         815         876         254           "         400         10         19         169         002         169         170         815         876         254         876         254         876         254         876         254         876         254         876         256         254         876         277         279         876         279	=	#	± .	4.5	23	8.91	0.03	16 8	6 91	35.8	12.54	10.9	58.7	8:01	5.12	1.5	23.9
B (170)         186         15         20         168         0.11         168         172         606         583           """ 400         ""         20         168         0.02         169         170         8.15           """ 400         10         19         169         0.02         169         170         8.15           """ 400         10         15         22         170         0.02         170         171         170         8.15           """ 470         17         22         170         0.02         170         171         170         8.15           """ 200         0.75         21         189         0.05         174         170         171         171         171         171         171         171         171         171         171         171         171         171         171         171         172         174         188         171         171         172         174         188         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171         170         171																	
B(17)         100         1         68         002         168         169         626         254           1         300         1         1         169         002         169         170         839         876           1         400         1         1         169         002         170         171         100         875         876         876           1         200         40         40         21         197         004         196         198         202         561           1         200         0.75         24         189         0.05         188         190         27.97         561           1         200         0.75         24         189         0.05         174         179         304         18.88           1         200         1.0         1.0         1.0         1.1         170         0.1         174         179         304         18.88           1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1	August 23	B (170)	186	1.5	20	16.8	0.11	16.8	17.2	9 09	5 83	45.0	73.7	33.3	4.09	23.9	40.7
E(172)         100         10         19         169         002         169         170         839         876           B(30)         "         22         170         0.05         170         171         710         815           "         470         15         22         171         0.02         170         171         710         815           "         530         "         22         171         0.02         170         171         77         174         188         815         815         815         561           "         200         0.75         24         189         0.05         188         190         220.5         4150         37.9         4150         4170         188         190         220.5         4150         4170         188         190         220.5         4150         171         174         18.8         33.70         23.8         41.20         41.0         41.0         41.0         41.0         41.0         41.0         41.0         41.0         41.0         41.1         41.0         41.1         41.0         41.1         41.0         41.1         41.1         41.0         41.1         41.1 </td <td>. =</td> <td>:</td> <td>300</td> <td>:</td> <td>20</td> <td>16.8</td> <td>0 02</td> <td>16.8</td> <td>6'91</td> <td>62.6</td> <td>2.54</td> <td>58.2</td> <td>68.5</td> <td>59.3</td> <td>5.02</td> <td>42.6</td> <td>63.1</td>	. =	:	300	:	20	16.8	0 02	16.8	6'91	62.6	2.54	58.2	68.5	59.3	5.02	42.6	63.1
E(171)         100         1.5         22         170         0.05         170         171         815           D(171)         100         4.0         21         197         0.04         196         198         23.2.7         27.97           "         200         0.75         24         18.9         0.05         188         190         20.55         41.50           "         304         1.5         21         176         0.12         174         179         30.4         188           "         304         1.6         1.7         0.20         188         190         20.5         41.50           "         300         1.0         16         17.1         0.20         16.9         17.4         17.9         30.4         188           "         404         "         18         17.1         0.20         17.1         17.2         17.4         17.9         30.4         18.8           "         80         2.         18         17.1         0.02         17.0         17.1         48.0         22.0         17.0         17.1         48.0         22.0         22.0         17.0         17.1         48.0	:	=	100	1.0	61	6.91	0.02	16.9	17.0	83.9	8.76	71.3	9 66	3.0	2.47	1.5	7.1
D(171)         100         4.0         21         171         0.02         17.0         171         551         561           D(171)         100         4.0         21         19.7         0.04         196         198         23.7         27.97           "         200         0.75         24         18.9         0.05         18.8         19.0         220.5         41.50           "         304         1.5         21         17.6         0.12         17.4         17.9         30.4         18.8           "         304         1.5         21         17.6         0.12         17.4         17.9         30.4         18.8           "         404         "         17.0         0.12         17.4         17.9         33.7         25.80           "         404         "         17.0         0.12         17.0         17.1         18.3         35.7           "         404         "         18         17.1         0.12         17.0         17.1         48.7         35.87           "         8.0         1.5         2.1         17.1         0.05         17.1         17.2         49.7         49.7	:	:	470	1.5	22	17.0	0.05	17.0	17.1	710	8.15	54.9	93.3	0 †	2.79	1.5	7.1
D(171)         100         40         21         197         0.04         196         198         232.7         2297           "         200         075         24         189         0.05         188         190         2205         4150           "         304         1.5         24         189         0.05         188         190         2205         4150           "         304         1.5         24         189         0.05         174         179         30.4         1858           "         300         20         10         16         171         0.20         169         176         176         178         1858           "         404         "         18         171         0.12         170         173         497         200           "         404         "         18         171         0.12         170         171         487         3784           "         80         10         17         0.05         171         171         480         3784           "         100         10         17         0.05         171         171         480         3784	:	3	630	:	22	17.1	0.02	17.0	17.1	6.72	5 61	8 18	79.3	11.7	2.74	1.5	12.7
D(71)         100         40         21         197         0.04         196         198         232.7         27.97           "         200         0.75         24         18.9         0.05         18.8         190         220.5         41.50           "         304         1.5         21         176         0.02         174         179         30.4         41.50           "         300         1.0         16         17.1         0.20         169         170         220.5         41.50           "         404         "         18         17.1         0.20         169         170         171         53.3         35.57           "         404         "         18         17.1         170         17.2         49.7         2.00           "         404         "         80         22         169         0.02         169         17.0         17.2         49.7         2.00           "         580         1.5         2.1         17.1         0.05         17.1         17.2         48.0         37.84           "         2.20         1.5         2.3         17.2         0.05         17.1<						1		4			0	9	0.00	9	9	-	7.1
E(172)         200         075         24         18.9         0.05         18.8         19.0         220.5         41.50           E(172)         200         1.6         1.7         1.7         0.12         17.4         17.9         30.4         18.8           E(172)         200         1.0         1.6         17.1         0.20         16.9         17.6         337.0         25.80           E(172)         200         1.0         1.0         1.0         1.0         17.1         17.1         17.1         18.3         33.0         25.80           E(172)         3.00         2.0         1.9         17.1         0.12         17.0         17.1         58.3         35.57         35.87           E(173)         1.0         1.5         2.2         16.9         0.02         17.0         17.1         49.7         49.7         2.0           E(173)         1.00         1.0         2.3         17.0         0.05         17.1         17.2         17.4         48.0         35.87           E(173)         1.00         1.0         2.0         17.2         17.4         17.9         36.01           E(173)         1.00	August 23	D(171)	100	0.4	21	19.7	0.04	961	8 61	232.7	27.91	170.4	281.0	٠. <u>.</u>	61.1	<u>.</u>	- 1
E(172) 200 1.0 16 17.1 0.20 16.9 176 337.0 25.80 17.0 17.1 0.20 16.9 176 337.0 25.80 17.0 17.1 0.20 17.1 0.20 17.1 0.20 17.1 0.20 17.1 0.20 17.1 0.20 17.1 0.20 17.1 0.20 17.1 0.20 17.1 0.20 17.1 0.20 17.1 0.20 17.1 0.20 17.2 0	=	:	200	0.75	57	6'81	0.05	8.8	0.61	220.5	41.50	8.17.1	552.4	1.1	71.1	<u>.</u>	1.7
E(172)         200         1.0         16         17.1         0.20         156         17.0         25.80         25.80            404          18         17.0         0.04         17.0         17.3         83.7         25.80            404          18         17.1         0.12         17.0         17.5         49.7         2.00            5.80         1.5         2.1         17.1         0.12         17.0         17.5         49.7         2.00            5.80         1.5         2.1         17.1         0.05         17.1         17.2         49.7         2.00            6.5         2.3         17.0         0.05         17.1         17.2         48.0         37.84            2.20         1.7         0.05         17.1         17.4         29.8         5.7            3.00         2.0         2.1         17.1         0.05         17.1         17.4         29.8         5.7            3.00         2.0         2.2         17.1         17.4         29.8         5.7	:	3	304	<u>s:</u>	21	176	0.12	17.4	17.9	30.4	18.58	-10.5	539	8.0	3.56	2	17.7
E(172)         200         1.0         17.1         0.20         17.1         0.20         17.1         0.20         17.1         0.20         17.1         0.20         17.1         0.20         17.1         0.20         17.1         0.20         17.1         0.20         17.1         0.20         17.1         0.20         17.2         17.0         17.1         3.20         2.00           "         \$8.0         1.5         2.1         17.1         0.05         17.1         17.2         49.7         2.00           "         \$6.5         2.3         17.0         0.05         17.1         17.2         41.7         3.20           "         \$6.5         2.3         17.0         0.05         17.1         17.2         48.0         37.84           "         \$2.0         17.3         0.05         17.1         17.2         48.0         37.84           "         \$3.0         2.1         17.1         0.05         17.1         17.4         29.8         5.7           "         \$40.4         2.5         2.1         17.2         0.05         17.1         17.4         29.8         5.7           "         \$40.4         2.			000	-	71	1.2.1	0.70	16.0	17.6	117.0	25.80	1 202	375 5	6	1.36	5.1	7.1
F(173)         100         1.0         17.1         0.0         17.1         0.0         17.2         17.0         17.3         49.7         2.00            580         1.5         21         17.1         0.05         17.1         17.2         49.7         2.00            580         1.5         21         17.1         0.05         17.1         17.2         49.7         2.00            6.5         2.3         17.0         0.05         17.1         17.2         48.0         37.84            220         1.75         2.0         17.3         0.05         17.1         17.2         48.0         37.84            220         1.75         2.1         17.1         0.05         17.1         17.2         48.0         37.84            300         2.0         2.3         17.2         0.05         17.1         17.4         29.8         5.7            40.4         2.5         2.1         17.2         0.05         17.1         17.4         17.9         36.01            40.4         2.5         2.3         17.2         0.05 <td>August 23</td> <td>E (1/7)</td> <td>300</td> <td>2.0</td> <td>0 0</td> <td>17.0</td> <td>07.0</td> <td>17.0</td> <td>17.1</td> <td>283</td> <td>35.57</td> <td>12.0</td> <td>142.5</td> <td>× = =</td> <td>1.25</td> <td>. <u></u></td> <td>7.1</td>	August 23	E (1/7)	300	2.0	0 0	17.0	07.0	17.0	17.1	283	35.57	12.0	142.5	× = =	1.25	. <u></u>	7.1
F(173)         100         1.0         22         169         002         169         170         41.7         3.20            580         1.5         21         171         0.05         171         172         57.7         35.87            6.5         23         17.0         0.05         17.1         17.2         57.7         35.87            220         1.0         20         17.3         0.05         17.1         17.1         48.0         37.84            220         1.75         21         17.1         0.05         17.1         17.2         17.4         239.0         414.43            220         1.75         21         17.1         0.05         17.1         17.2         18.20         48.20            4.04         2.5         21         17.2         0.05         17.1         17.4         29.8         5.7            4.04         2.5         2.1         17.2         0.05         17.4         17.9         36.01              9.5         2.3         17.2         0.03         17.1	:	=	300	) <u>:</u>	<u>`</u>	171	0.13	17.0	17.5	49.7	2.00	46.5	55.2	47.9	2.51	463	519
F(173)         580         1.5         21         171         0.05         17.1         17.2         57.7         35.87           F(173)         100         1.0         23         17.0         0.05         17.1         17.2         37.7         35.87           F(173)         100         1.0         20         17.3         0.05         17.2         17.4         48.0         37.84           **         220         1.75         21         17.1         0.05         17.1         17.2         37.9         41.43           **         220         1.75         21         17.1         0.05         17.1         17.4         29.8         5.7           **         90         2.5         17.0         0.05         17.1         17.4         17.9         36.01           **         90         2.5         17.2         0.05         17.1         17.2         28.4         25.1           **         9.5         2.3         17.2         0.05         17.1         17.2         28.4         25.1           **         100         10         19         17.2         0.06         17.2         17.4         49.4         1410	:	**	=	0 %	22	16.9	0 02	16.9	17.0	41.7	3.20	35.7	46.9	41.0	3.57	35.1	46.3
F (173)         100         1.0         20         17.0         0.05         17.2         17.4         239.0         41.43           e (173)         100         1.0         20         17.3         0.05         17.2         17.4         239.0         41.43           e (173)         100         1.0         20         17.3         0.05         17.1         17.2         329.5         48.20           e (173)         100         20         23         17.2         0.05         17.1         17.4         29.8         5.7           e (173)         104         2.5         21         17.2         0.05         17.1         17.4         17.9         36.01           e (175)         100         10         17.2         0.05         17.1         17.2         23.1         23.1           e (175)         100         10         19         17.3         0.04         17.3         17.2         23.1         39.1           e (175)         10         19         17.2         0.00         17.2         17.4         49.4         14.10           e (175)         10         25         26         17.1         17.2         17.4         24.7 </td <td>:</td> <td>;</td> <td>580</td> <td>1.5</td> <td>21</td> <td>17.1</td> <td>0.05</td> <td>17.1</td> <td>17.2</td> <td>57.7</td> <td>35.87</td> <td>-27.6</td> <td>140.4</td> <td>10.3</td> <td>7 04</td> <td>1.5</td> <td>29.5</td>	:	;	580	1.5	21	17.1	0.05	17.1	17.2	57.7	35.87	-27.6	140.4	10.3	7 04	1.5	29.5
F(173)         100         1.0         20         17.3         0.05         17.2         174         239.0         41.43           "         220         1.75         21         17.1         0.05         17.1         17.2         329.5         48.20           "         300         20         23         17.2         0.05         17.1         17.4         29.8         5.77           "         404         2.5         21         17.2         0.05         17.1         17.4         29.8         5.77           "         404         2.5         21         17.2         0.05         17.1         17.2         16.29           "         9.5         2.3         17.2         0.03         17.1         17.2         28.4         25.17           G(175)         10         10         19         17.2         0.03         17.1         17.2         17.4         49.4         1410           "         200         2.5         2.6         17.2         0.00         17.2         17.4         49.4         1410           "         10.0         2.9         2.0         2.1         17.2         17.2         28.9         12.	:	*	*	6.5	23	17.0	0 0	17.0	17.1	48.0	37.84	-594	105.5	10.3	5.43	1.5	183
F(1/3)         100         1.0         20         17.3         0.03         17.2         17.2         17.3         48.20           "         220         17.5         21         17.1         0.05         17.1         17.2         48.20           "         300         20         23         17.0         0.05         17.1         17.4         29.8         5.27           "         404         2.5         21         17.0         0.05         17.2         17.4         17.9         36.01           "         9.5         2.3         17.2         0.05         17.1         17.4         17.9         36.01           "         9.5         2.3         17.2         0.05         17.1         17.4         17.9         36.01           "         9.5         2.3         17.2         0.03         17.1         17.2         28.4         25.17           "         3.0         1         17.2         0.04         17.3         17.4         49.4         14.10           "         2.0         2.1         17.2         0.06         17.2         17.4         49.4         14.10           "         2.0         2.5 <td></td> <td>t</td> <td>6</td> <td>-</td> <td>ć</td> <td></td> <td>30.0</td> <td>17.7</td> <td>17.4</td> <td>739.0</td> <td>41.43</td> <td>1367</td> <td>2011</td> <td>5 1</td> <td>000</td> <td>5  </td> <td>- 1</td>		t	6	-	ć		30.0	17.7	17.4	739.0	41.43	1367	2011	5 1	000	5	- 1
220         173         24         171         0.05         171         174         255         27           300         20         23         172         0.05         171         174         29         527           404         2.5         21         172         0.05         172         174         159         3601           "         404         2.5         21         172         0.05         172         174         179         3601           "         9         23         172         0.03         17.1         172         284         25.17           "         9         23         172         0.03         17.1         172         284         25.17           "         3         2         172         0.03         17.1         172         284         25.17           "         3         2         172         0.06         172         174         494         1410           "         2         2         17.2         0.00         172         17.2         32.1         391           "         1         10         2         17.1         0.05         17.1	August 2.5	F(1/3)	001	5	07 7	17.7	50.0	7.7.	17.7	3.002	48.20	135.5	393.6	9.6	2.20	5	7.1
500         20         23         172         0.03         171         173         0.02         171         173         0.02           "         404         2.5         21         170         0.03         171         174         179         3601           "         404         2.5         23         172         0.03         171         179         3601           "         95         23         172         0.03         171         172         284         25.17           G(175)         100         10         19         173         0.04         173         173         36.3         9.95           "         200         21         172         0.06         172         174         494         1410           "         200         2.5         26         17.1         17.2         32.1         3.91           "         10.0         29         17.1         0.05         17.1         17.2         28.9         12.28           "         2.0         24         17.3         0.06         17.2         17.4         24.7         5.82	: :	: 3	977	C - C	77		50.0	17.1	17.1	20.8	5 27	8 2	39.7	34.1	5 13	183	704
G(175) 100 10 19 172 0.05 172 174 179 3601 172 0.05 177 172 284 25.17 172 0.06 172 172 174 1410 172 0.00 172 172 172 172 172 172 172 172 172 172	: :	: :	300	0.0	5.7	2 / 1	500	1 / 1	17.1	15.0	16.20	36.0	3 8 8	26.8	55.8	7.1	35.1
G (175) 100 1 0 19 172 0.03 17.1 172 28.4 25.17  G (175) 100 1 0 19 173 0.04 17.3 17.5 35.5 9.95  " 200 2.5 26 17.2 0.00 17.2 17.2 32.1 3.91  " 10.0 29 17.1 0.05 17.1 17.2 28.9 12.28  " 266 2.0 24 17.3 0.06 17.2 17.4 24.7 5.82	:	3	9	9.6		0.71	200	17.5	17.4	17.9	36.01	20.7	99.2	8.2	8.40	5	23.9
G (175) 100 10 19 173 004 173 175 355 9.95 17.2 200 2.5 26 17.1 0.05 17.1 17.2 200 17.2 17.1 17.2 200 17.1 17.2 200 2.9 17.1 17.2 289 12.28 17.1 266 2.0 24 17.3 006 17.2 17.4 247 5.82	=	:	*0*	5.0	23	7.7	0.03	17.1	17.2	28.4	25.17	8.6-	103.1	12.2	66.9	1.5	23.9
G (175)         100         10         19         173         0 04         173         175         35.5         9.95           "         200         21         172         0 06         172         174         494         1410           "         200         2.5         26         17.2         0.00         172         17.2         32.1         3.91           "         10.0         29         17.1         0.05         17.1         17.2         28.9         12.28           "         2.0         2.0         24         17.3         0.06         17.2         17.4         24.7         5.82						1			1		1	2					
"         30         21         172         0.06         172         174         494         1410           "         200         2.5         26         172         0.00         172         17.2         32.1         3.91           "         "         10.0         29         17.1         0.05         17.1         17.2         28.9         12.28           "         26         2.0         24         17.3         0.06         17.2         17.4         247         5.82	August 23	G(175)	100	0	19	17.3	0 04	17.3	17.5	35.5	9.95	11.3	51.1	11.2	3.56	7.1	18.3
"         200         2.5         26         17.2         0.00         17.2         17.2         32.1         3.91           "         "         10.0         29         17.1         0.05         17.1         17.2         28.9         12.28           "         2.6         2.0         24         17.3         0.06         17.2         17.4         24.7         5.82	, =	3	2	3.0	21	17.2	900	17.2	17.4	46.4	14 10	23.5	77.2	09	3.29	1.5	12.7
	:	=	200	2.5	26	17.2	0.00	17.2	17.2	32.1	3.91	22.1	39.5	37.3	3.14	29.5	40.7
266 2.0 24 17.3 0.06 17.2 17.4 24.7 5.82	:	=	=	10.0	29	17.1	0.05	17.1	17.2	289	12.28	-25.9	43.4	28.5	4.89	12.7	35.1
	z	=	266	2.0	24	17.3	900	17.2	17.4	247	5.82	12.0	32.6	30.9	9.66	23.9	40.7
. 8.0 25 172 0.00 17.2 172 19.8 14.15	=	=	:	8.0	25	17.2	0.00	17.2	17.2	8.61	14.15	-6.7	416	17.0	6.58	1.5	23.9

Table 2. continued.

August 24 AB ()	Distance Irom CDIV.	Distance from CDN. Meter Depth, m	Number of		remperature, 'C	מוני כ			Current reading, degrees	Caraca Contract					
	shore, m		Readings	mean	s.d.	min.	max	теап	p.s	mın.	тах.	mean	s.d.	min.	тах
	100	0.1	18	9:91	0.48	15.9	17.0	283 2	87.19	129.2	369.9	5 4	2.80	1.5	12.7
	200	1.0	20	17.0	0.05	16.9	171	65.8	2 85	8 65	902	46.0	1.22	40.7	46.3
	;	3.0	0.91	17.0	4.12	17.0	0.41	66.5	16.44	58.4	70.6	39.0	9 74	35.1	40.7
:	300	1.5	81	17.0	0.00	17.0	17.0	619	2.62	999	67.5	6 09	2.73	57.5	63.1
:	707	0.75	7	17.1	0 10	16.7	171	83.2	44 47	-64.6	134.1	5.1	3.42	1.5	12.7
:	620	1.0	24	17.1	0.03	17.1	17.2	0.89	8.06	54.9	93.6	16.7	4.11	12.7	29 5
:	:	3.0	61	17.0	0.04	17.0	17.1	8 55	7.52	36.1	65.4	12.1	3.09	7.1	18.3
August 24 D (171)	001	0.5	20	18.6	0.33	17.8	19.3	314.2	43,48	255.6	387.7	1.5	0.00	1.5	1.5
	200	0.75	81	18.2	0.13	17.9	18.3	209 7	77.76	47.9	307.6	2.7	2.33	1.5	7.1
:	300	1.5	21	17.6	0.28	17.0	18.0	6.19	22.18	1 62	103.8	8.4	4.54	1.5	18.3
August 24 E (172)	98	0.3	17	16.5	0 12	16.4	17.0	1943	42.14	144.2	263.9	1.5	0.00	- 5	1.5
=	200	0.75	61	16.8	0.28	191	17.0	216.7	58.31	134.5	323.3	2.1	1.72	5.1	7.1
4	330	2.0	61	17.2	80.0	6.91	17.3	38.8	15.54	16.9	74.1	23.3	4 02	12.7	29.5
:	=	5.0	17	17.1	0.07	6.91	17.2	34.4	15.38	7.4	0 59	50.9	4.35	12.7	23.9
=	423	2.0	18	17.1	00.00	17.1	171	50.1	<b>4</b> 86	38.8	57.3	28 6	2.80	23 9	35.1
:	=	8.0	15	17.0	0.04	17.0	17.1	45.2	9 9 1	26.3	64.0	8.91	6 62	1.7	29.5
:	580	2.0	20	17.1	0.04	169	171	446	9.92	27.0	62.6	27.3	5.43	7.1	35.1
:	:	7.0	91	17.0	0.12	9 91	17.1	368	11 87	14.1	0 19	19.3	6.92	1.5	29.5
August 24 F (173)	100	0.1	20	17.2	0.22	16.7	17.3	263.4	74.25	155 4	373.7	2.3	2.00	1.5	1 1
:	214	1.5	22	17.2	0 19	17.1	17.8	310.3	45.99	190 0	366 4	6'8	4 27	1.5	12.7
:	300	2.0	20	17.2	80.0	17.2	17.5	29.1	6.80	17.9	47.2	289	3.50	18.3	35.1
:	=	8.0	16	17.1	0.02	17.1	17.2	24.9	11.35	2.5	51.4	28.5	4 52	12.7	35.1
**	406	2.0	21	17.2	0.07	16.9	17.3	22,1	5,14	13.4	32.2	33.0	8.01	12.7	40.7
3	:	0.9	15	17.2	0.05	17.1	17.2	20.4	9 27	30 30	47.6	28 8	2.79	23 9	35.1
August 24 G (175)	~100	0.1	27	17.3	0 10	16.9	17.5	330	7.28	183	1.65	11.2	4.20	1.5	18 3
:	:	3.0	27	17.1	0.12	8.91	17.2	30.4	16.84	-42.3	504	7.4	4.78	1.5	217
:	200	2.5	21	17.2	00.00	17.2	17.2	33.3	2.92	27.3	406	30.0	3.41	18.3	35.1
:	:	10.5	20	17.1	0.12	8.91	17.2	29.9	10.28	10.2	47.2	19.4	11.00	1.5	29.5
:	285	2.0	20	17.2	00.00	17.2	17.2	21.3	01.9	2.5	30.5	28.1	3,49	23,9	35.1
:	285	8.0	19	17.1	0.18	16.7	17.2	40.4	10.27	20 0	1.09	13.3	6 77	1.5	23.9

NOTES:

"mean" = arithmetic mean
"s.d" = standard deviation.
"~" = approximately.
Transect "AB" is located approximately midway between Transects "A" and "B"

## 5.1.4 Interpretation of River Current and Plume Tracking Results

Reviewing the measured river current data from all dates, it can be readily seen that the river flow regime can be split into two general classes, namely "strong" and "weak".

The "strong" flow regime is characterized by: a relatively large mean current speed of over 20 cm.sec<sup>-1</sup> near the surface; a mean flow direction coincident with the mean downstream direction of the river; and, relatively small standard deviations of both the current direction and current speed (i.e., with respect to their mean values). This regime occurs in the deeper portions of the river. Stations typical of this regime include:

```
Transect B - 200, 300, 400 metres from the Ontario shore
Transect E - 400, 500

Transect F - 400, 500

Transect G - 200, 300

Transect H - 100, 200

"
```

The "weak" flow regime is characterized by: a relatively small mean current speed of under 10 cm.sec<sup>-1</sup>, and relatively large standard deviations of both the current direction and current speed (i.e., with respect to their mean values). This regime is particularly prevalent over the shallow "shelf" region, on the north side of the river where the outfall discharges. Stations typical of this regime include:

```
Transect B - 100 metres from the Ontario shore
Transect D - 100, 200, 300 "
Transect E - 100, 200 "
Transect F - 100, 200, 300 "
```

As can be seen from Figures 6 and 7, the drogues followed different travel paths from the outfall, depending upon daily wind conditions. Some general characteristics of these paths are summarized as follows:

- The paths are approximately parallel to shore (in the downstream direction) under SW and ESE wind directions (e.g., June 27 and August 22).
- The paths tend to run initially outward from shore at an approximate angle of 45 degrees for the first 200 metres or so of travel, under NE wind conditions (e.g., June 28, August 23 and August 24).
- The paths become parallel to the mean downstream river direction, after they reach the deeper portion of the river, (see August 23 and 24).

It may be concluded that, due to its "weaker" nature, the flow over the shallow "shelf" (where the outfall discharges) is more susceptible to wind variation than the deeper, faster-flowing waters of the main channel.

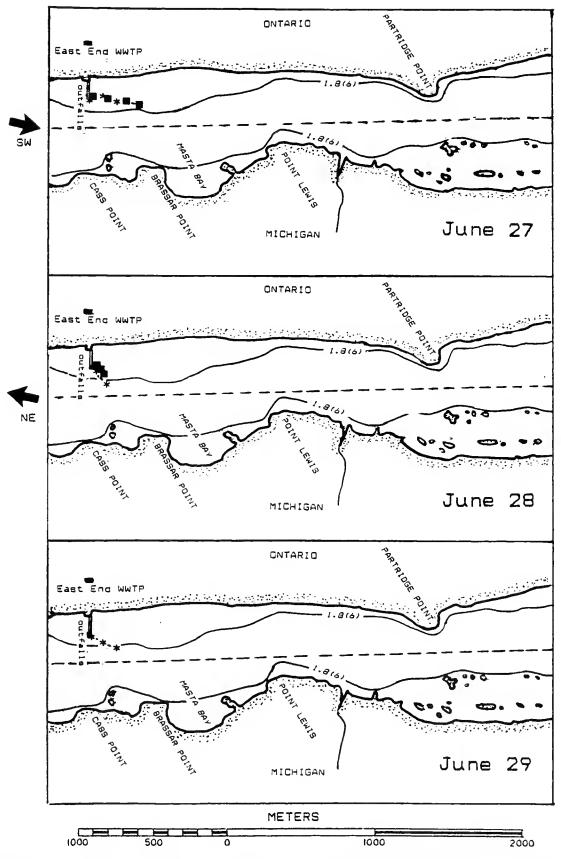


Figure 6. Drogue travel paths (\* and •) on June 27, 28 and 29, 1989. The 1.8 metre (6 foot) water depth contour and average wind direction are included. The dashed line represents the Canada-United States border.

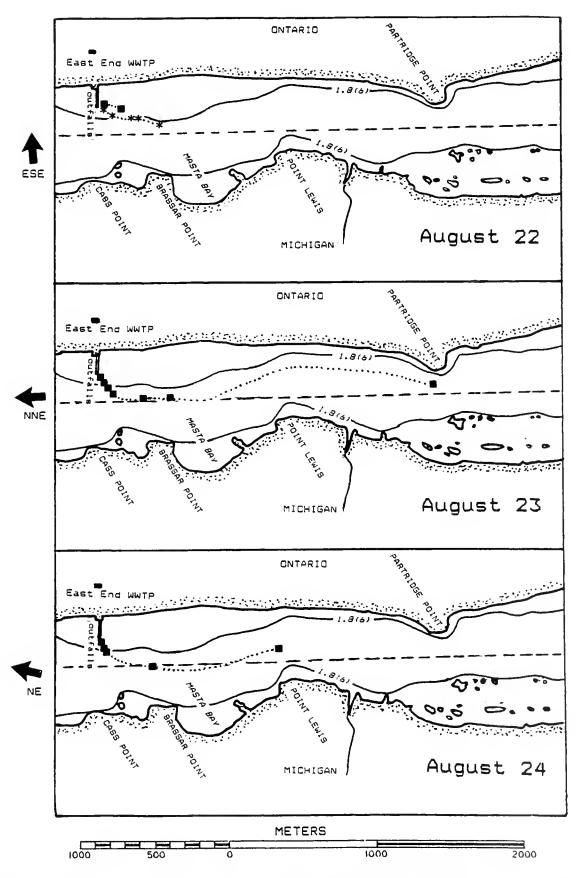


Figure 7. Drogue travel paths (\* and •) on August 22, 23 and 24, 1989. The 1.8 metre (6 foot) water depth contour and average wind direction are included. The dashed line represents the Canada-United States border.

#### 5.2 Bacterial and Chemical Measurements

The maximum coefficients of variation (CV) for conventional chemical parameters in 19 pairs of blind duplicate (split) effluent and river water samples were usually considerably lower (1.4 to 46 %) than the maximum suspended solids, turbidity, phenolics, iron, zinc and bacteria (94 to 138 %). For many sample pairs, the results were identical or very similar (Appendix, Table A-5), indicating that laboratory analytical variability was very low. The higher variability for some parameters was due either to some samples with parameter concentrations near or below the respective minimum reportable values (e.g., phenolics, iron, zinc), which were assigned a value of zero for statistical calculations, or to the influence of particulates on the results of particulate-associated analytes (e.g., turbidity, bacteria, trace metals). The field blank results (Appendix, Table A-6) show that most of the field data for conductivity, chloride, turbidity, suspended solids, ammonia, total Kjeldahl nitrogen, total phosphorus, iron, and bacteria are above the distilled water "background".

The coefficients of variation range for most analytical parameters in two pairs of blind duplicate (split) sediment samples were usually quite low (0 to 67 %) and similar to the available laboratory CVs (Appendix, Table A-7), indicating that the local within-station sediment heterogeneity was relatively low. The maximum CV of 116 % was for fecal *Streptococcus* is in part due to the approximate nature of the results).

## 5.2.1 Effluent Quality

Densities of bacteria in the WWTP final effluent varied greatly, both between different survey days as well as within days (Table 1). For example, fecal coliforms ranged from 2,300 organisms.dl<sup>-1</sup> (organisms per 100 ml) to 75,000.dl<sup>-1</sup> during June 27, 1989, and reached a peak of 1,040,000 organisms. dl<sup>-1</sup> at 14:00 hours on August 22. Densities of *Escherichia coli* and *Pseudomonas aeruginosa* varied along with those of fecal coliforms (Table 1). Although the data set for *E. coli* is incomplete, this bacterium accounted for 42% to 85% of the fecal coliforms in the final effluent.

Conductivity, pH, chloride, ammonium and phenolics levels in the WWTP discharge changed relatively little during each sampling period, although all but ammonium were noticeably lower in the second survey (Table 1). Overall, turbidity and concentrations of suspended solids, total Kjeldahl nitrogen, total phosphorus, iron and zinc varied somewhat more, with ranges of 5.7 to 19.0 FTU, 18.2 to 45.3 mg.l<sup>-1</sup>, 18.0 to 31.8 mg.l<sup>-1</sup>, 0.60 to 2.42 mg.l<sup>-1</sup>, 680 to 1200 µg.l<sup>-1</sup> and 16 to 60 µg.l<sup>-1</sup>, respectively (Table 1). Concentrations of phosphorus in one of three samples on June 29 and two of three samples on August 22 exceeded the 1 mg.l<sup>-1</sup> (monthly average) GLWQA objective for WWTP discharges to the upper Great Lakes (IJC, 1988).

### 5.2.2 Effluent Loadings

The calculated loadings of bacteria and contaminants in Table 3 represent an important measure of the potential impact of the East End WWTP discharge on waters of the St. Marys River. Mean daily loadings were greatest for all parameters on August 22 (Fig. 8), reflecting the high discharge rate and the elevated concentrations in the effluent (Table 1). For example, relative to the lowest mean daily loading on August 24<sup>th</sup>, loadings on August 22<sup>nd</sup> were over 200 times

East End WWTP final effluent loadings. Table 3.

Sampling time	time	Discharge	Suspended	Chloride	Fecal coliforms	Eseherichia coli	Pseudomonas	Ammonium	Kjeldahl	Phosphorus Phenolics	Phenolics	Iron	Zine
Date	Time	Kate 10'm' day'	Solids kg day <sup>1</sup>	kg day⁴	10° org.day ¹	10° org day	aeruginosa 10° org.day ¹	kg day '	Nitrogen kg.day <sup>-1</sup>	kg day '	kg.day <sup>1</sup>	kg day ¹	kg day <sup>,1</sup>
70 earl	0.43.4	> 81	> 808	1164.0	2887	0.000	670	7 708	0 109	73.1	7	16.7	1.3
	0.4757	40.0	828.0	3648.0	920	089	2 00	6280	728.0	26.4	9 9	2 9 8	1 9
	0.5243	40.0	0.092	3632.0	20000	13200	-13	808.0	924 0	25.6	67	28.4	1.3
	mean	39.5	6 262	3547 1	8101	5644	~31	6715	775 4	24.9	1.7	36.4	1.3
June 28	:	38.0	7714	3317.4	29260	155800	11	6498	748.6	31.9	1.8	45.6	6.1
	:	30.0	576.0	2763.0	1590	1200	-35	5340	627.0	25.2	1.4	24.9	1.0
	;	30.0	639.0	26490	1800	1080	86~	654.0	756.0	27.3	1.7	24.0	6.0
	mean	32.5	656.5	2899 0	4393	2905	~73	610.7	8 802	27.9	9.1	30.1	1.2
June 29 (	0.3958	37.0	1095.2	3185.7	<u>*************************************</u>	340	=	8.909	791.8	37.7	61	31	2.2
	0 4375	30.0	642.0	26580	39600	16500	1380	486.0	594.0	24.0	1.5	:	7
J	0.4792	31.0	564.2	2796.2	4030	2790	668	533.2	632.4	19.8	1.4	21.1	1.3
	mean	32.5	7345	2869 1	5061	2501	-240	539.2	6 999	26.0	91	24,7	16
Aug 22 0	0 4583	36.0	7596	2707.2	25920	:	317	712.8	8496	28.1	<del>-</del> -	27.7	8.0
	0 5208	0.09	1920.0	4290 0	342000	;	1980	14940	0.8061	78.0	:	72.0	2.2
Ç	0.5833	48.0	21744	3192.0	499200	;	3648	1075.2	14640	116.2	2.4	57.6	3.0
	mean	47.0	14711	3336.1	164252	1	1318	1046.7	1334.3	63.5	2.0	48.6	1.7
Δ110 73 (	0.375	30.0	738.0	0.010.0	0171	;	99	0 165	747 0	25.5	<del>ग</del>	16.4	0.7
	0 4167	37.0	11729	26714	16650	:	244	7400	906 5	27.7	1.7	37.0	80
9	0.4583	37.0	969 4	2741.7	2035	:	170	7067	913.9	24 1	1.6	29.2	9:0
	mean	34.5	9419	24630	3628	;	0+1	676.2	852.2	25.9	1.5	30.6	0.7
Aug 24 (	0.375	30.0	945 0	2025.0	420	300	9-	564.0	717 0	27.0	1.3	23.1	0.7
	0 4167	35.0	885.5	2485.5	1505	910	318	637.0	780.5	26.6	1.3	25.6	6.0
ر	0.4583	37.0	9.569	2423.5	740	574	212	8.089	834 4	22.2	E: 1	26 6	8.0
	mean	33.9	833.9	2308.8	777	539	~38	625.8	776.6	25.1	1.3	25 1	8 0
Study Mean	ean	363	8736	2869.7	0199	2168	-125	6.879	828.6	30.1	1.6	31.7	1.2

NOTES

"mean" = geometric (log<sub>10</sub>) mean
"..." = information or data not available (sample spoiled in laboratory accident)
"..." approximately.
Bolded discharge rate exceeds the design capacity

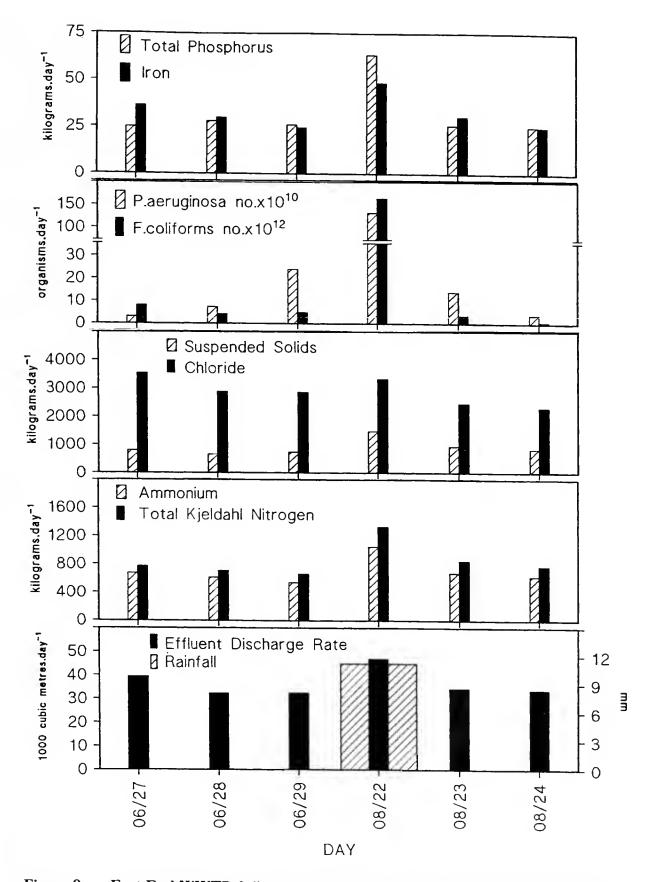


Figure 8. East End WWTP daily average discharge rates and loadings of selected contaminants.

greater for fecal coliform bacteria, and about two times greater for suspended solids, ammonia, total Kjeldahl nitrogen, total phosphorus, iron and zinc (Table 3).

## 5.2.3 River Water Quality

The WWTP effluent loadings (Table 3) had a noticeable effect on water quality in the Lake George Channel, not only immediately below the discharge at Transect C (Station 34), but also for some distance downstream. This impact was reflected both by concentrations as well as by exceedences of Provincial (PWQO) and Great Lakes Water Quality Agreement (GLWQA) objectives (Table 4). Fecal coliform, *Escherichia coli* and *Pseudomonas aeruginosa* bacteria, conductivity, chloride, ammonia nitrogen, total Kjeldahl nitrogen, phosphorus, phenolics, iron and zinc levels increased noticeably downstream of the WWTP discharge during both surveys (see Figs. 9 through 12).

The most pronounced effect on bacterial levels was found on August 22 and 23 during, and immediately following, a period of heavy rainfall and high effluent loadings (see Sections 5.1.1, 5.2.2, and Table 3). For example, densities of fecal coliform and *E. coli* bacteria reached a peak of 19,000 organisms.dl<sup>-1</sup> and 16,000 organisms.dl<sup>-1</sup>, respectively, at 100 m downstream of the effluent discharge pipe on August 22. Faecal coliform densities exceeded the PWQO of 100 organisms.dl<sup>-1</sup> for the protection of recreational users for as far as Transect L (station 54) at Bell Point, some 4.7 km downstream (Fig. 12). A similar but less extensive trend was also evident for densities of *Pseudomonas aeroginosa*, with exceedences of the PWQO of 20 organisms.dl<sup>-1</sup> largely confined in downstream extent to 0.9 km at Transect F (Table 4).

Total phosphorus concentrations ranged from 33  $\mu$ g.l<sup>-1</sup> to 108  $\mu$ g.l<sup>-1</sup> immediately downstream of the WWTP discharge and these levels all exceeded the PWQO of 30  $\mu$ g.l<sup>-1</sup> for the prevention of excessive plant growth in rivers and streams (OMOE, 1984). Occasional samples from both the June and August surveys also exceeded the PWQO as up to 0.9 km downstream of the WWTP (Figs. 10 and 12).

The un-ionized ammonia PWQO of  $20~\mu g.l^{-1}$  for the protection of aquatic life was only exceeded on one day, immediately downstream of the WWTP discharge ( $26~\mu g.l^{-1}$  on August 24). Only two samples, taken on June 27 and on August 22, contained iron levels above the PWQ and GLWQA objective of  $300~\mu g.l^{-1}$  for the protection of aquatic life. These concentrations, 1,200 and 2,000  $\mu g.l^{-1}$ , respectively, correlated with noticeably elevated suspended solids concentrations in the water samples (Table 4 and Fig. 11).

The 1 µg.l<sup>-1</sup> PWQO for phenols to prevent tainting of edible fish flesh was frequently exceeded in samples collected from both upstream and downstream of the WWTP discharge. This indicates the presence and impact of upstream sources, in addition to the WWTP discharge.

Table 4. Summary of Lake George Channel water quality data.

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	Zinc µg.l¹	1 8 <t< td=""><td>T&gt;6.0</td><td>0.8<t< td=""><td>0.5<w< td=""><td>0.5<w< td=""><td>0.7<t< td=""><td>0.5<w< td=""><td>0.5<w< td=""><td>0.5<w< td=""><td>D 6&lt;1</td><td>2.5<t< td=""><td>0.5&lt;1</td><td>7.5</td><td>0.5<w< td=""><td></td><td>2.9</td><td>1-6<t< td=""><td>1&gt;5.7</td><td>1.9&lt;1</td><td>0 9&lt;</td><td>1.3&lt;7</td><td>21.0</td><td>× -</td><td>\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \</td><td>5.3</td><td>1-9-T</td><td>7.7.</td><td>166</td><td>17&lt;1</td><td>2.3&lt;1</td><td>7:</td><td>0.8&lt;1</td><td>2.1&lt;1</td><td></td></t<></td></w<></td></t<></td></w<></td></w<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<>	T>6.0	0.8 <t< td=""><td>0.5<w< td=""><td>0.5<w< td=""><td>0.7<t< td=""><td>0.5<w< td=""><td>0.5<w< td=""><td>0.5<w< td=""><td>D 6&lt;1</td><td>2.5<t< td=""><td>0.5&lt;1</td><td>7.5</td><td>0.5<w< td=""><td></td><td>2.9</td><td>1-6<t< td=""><td>1&gt;5.7</td><td>1.9&lt;1</td><td>0 9&lt;</td><td>1.3&lt;7</td><td>21.0</td><td>× -</td><td>\ 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	Total Kjeldahl N µg.l¹	061	170	541	170	170	091	130	130	9 2	0+1	130	0+1	<u>e</u> :	02-1		1140	1080	1010	2970	3404	091	019	007	200	2030	230	669	230	240	250	380	740	260	           
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	Ammonia N µg.l¹	21	38	7 7	36	9. T	36	22	22 6	7,7	- <u>8</u> 1	28	D<1	2 <t< th=""><th>9 70</th><th>ì</th><th>758</th><th>805</th><th>614</th><th>1900</th><th>2683</th><th>24</th><th>32</th><th>200</th><th>37</th><th>1730</th><th>09</th><th>569</th><th>80</th><th>342</th><th>80</th><th>198</th><th>543</th><th>76</th><th>   </th></t<>	9 70	ì	758	805	614	1900	2683	24	32	200	37	1730	09	569	80	342	80	198	543	76	 
Parameter	Chloride mg 1	0.58 <t< td=""><td>1.60</td><td>1.60</td><td>9. 9</td><td>1.50</td><td>1.30</td><td>1.30</td><td>1.40</td><td>9:1</td><td>04-1</td><td>1.20</td><td>1.20</td><td>1.50</td><td>05.1</td><td></td><td>180</td><td>00.9</td><td>3.10</td><td>7.40</td><td>10.92</td><td>1.50</td><td>0.70</td><td>0/1</td><td>9</td><td>10.50</td><td>1.55</td><td>09.4</td><td>1.70</td><td>2.50</td><td>1 80</td><td>2.20</td><td>3.15</td><td>1.70</td><td></td></t<>	1.60	1.60	9. 9	1.50	1.30	1.30	1.40	9:1	04-1	1.20	1.20	1.50	05.1		180	00.9	3.10	7.40	10.92	1.50	0.70	0/1	9	10.50	1.55	09.4	1.70	2.50	1 80	2.20	3.15	1.70	
Para	Conductivity Chloride	95.0	0.96	0.96	0.96	0 / 6	97.0	0'96	0.96	0.10	95.0	0 96	046	95.0	95.0		124 0	105.0	112.0	142.0	173.0	0.96	0.66	0.66	0.66	1640	0.86	109.0	0.181	0.901	0 66	103.0	111.0	0.86	1
	Pseud aeruginosa org.dl	₹>	<2	PF. 1	0 (	n v	<del>-1</del>	7	۵,	∵ √	7	4	<2	ζ,	7, ~	1	222	56	320	7	₹	2	ζ:	≘ -	, 0	150	= :	23	c <del>1</del>	. 71	22	12	9	7	
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Parameter		υ	mg.l <sup>-t</sup>	1.7	21.7	05.1	1.50	1.50	4.10	1.80	1.60	1.60	1.60	1.70	3.10	1.50	3.50	2.60	7.40	1.50	99	1.60	1.90	1.60	09:1	1.20	1.60	1.40	0+1	1.40	3.20	1.50	1.60	1.70	3.20	3.10	3.60	1 80	1.50	1.70	1.70	3.1	
Para		Conductivity	/s.cm   @25°C	76.	103 8	97.0	0.4%	97.0	0.811	0.86	0.96	97.0	0.66	98.5	0011	0.86	112,0	1110	147.0	97.0	0.86	0 66	0 66	0.86	0.86	0/6	97.0	0.76	0 96	0.79	0 601	97.0	0.86	97.0	105.0	105.0	98.0	97.0	0.86	0.66	0.86	107	1
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		Ехећенсћи сой	org.dl	₹	<del>-</del> 7	, 5	<u></u> } ⊆	148	7	₹	₹	128	<del>1</del> 8	28	9 7	, <u>%</u>	7.	12	08	의	0 ×	58	<b>7</b>	26	우 ;	3 62	7 09	32	91	8 <del>7</del>	52	80	98	89	7	97	3 7	2 2	588	150	09	*†	
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		Susp.Solids	mg.l <sup>3</sup>	2.6	2.5	0.3<1	0.7	× ×	3.5	5.6	1.7 <t< td=""><td>7.2</td><td>2.8</td><td>2.0<t< td=""><td>6.01</td><td>1&gt;17</td><td>. <del>1</del> 0.</td><td>2.9</td><td>4 2</td><td>6.9</td><td>1&gt;8.1</td><td>1.9<t< td=""><td>1 2<t< td=""><td>3.4</td><td>3.5</td><td>0.5<w< td=""><td><u> </u></td><td>0.3<w< td=""><td>2.3<t< td=""><td>0.4<w< td=""><td>26.9</td><td>4.7</td><td>1.8<t< td=""><td>3.9</td><td>0.9<t< td=""><td>3.0</td><td>8.0</td><td>1.6cT</td><td>3.1</td><td>1.3<t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<></td></t<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<>	7.2	2.8	2.0 <t< td=""><td>6.01</td><td>1&gt;17</td><td>. <del>1</del> 0.</td><td>2.9</td><td>4 2</td><td>6.9</td><td>1&gt;8.1</td><td>1.9<t< td=""><td>1 2<t< td=""><td>3.4</td><td>3.5</td><td>0.5<w< td=""><td><u> </u></td><td>0.3<w< td=""><td>2.3<t< td=""><td>0.4<w< td=""><td>26.9</td><td>4.7</td><td>1.8<t< td=""><td>3.9</td><td>0.9<t< td=""><td>3.0</td><td>8.0</td><td>1.6cT</td><td>3.1</td><td>1.3<t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<></td></t<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></t<>	6.01	1>17	. <del>1</del> 0.	2.9	4 2	6.9	1>8.1	1.9 <t< td=""><td>1 2<t< td=""><td>3.4</td><td>3.5</td><td>0.5<w< td=""><td><u> </u></td><td>0.3<w< td=""><td>2.3<t< td=""><td>0.4<w< td=""><td>26.9</td><td>4.7</td><td>1.8<t< td=""><td>3.9</td><td>0.9<t< td=""><td>3.0</td><td>8.0</td><td>1.6cT</td><td>3.1</td><td>1.3<t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<></td></t<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<>	1 2 <t< td=""><td>3.4</td><td>3.5</td><td>0.5<w< td=""><td><u> </u></td><td>0.3<w< td=""><td>2.3<t< td=""><td>0.4<w< td=""><td>26.9</td><td>4.7</td><td>1.8<t< td=""><td>3.9</td><td>0.9<t< td=""><td>3.0</td><td>8.0</td><td>1.6cT</td><td>3.1</td><td>1.3<t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<></td></t<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<>	3.4	3.5	0.5 <w< td=""><td><u> </u></td><td>0.3<w< td=""><td>2.3<t< td=""><td>0.4<w< td=""><td>26.9</td><td>4.7</td><td>1.8<t< td=""><td>3.9</td><td>0.9<t< td=""><td>3.0</td><td>8.0</td><td>1.6cT</td><td>3.1</td><td>1.3<t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<></td></t<></td></t<></td></w<></td></t<></td></w<></td></w<>	<u> </u>	0.3 <w< td=""><td>2.3<t< td=""><td>0.4<w< td=""><td>26.9</td><td>4.7</td><td>1.8<t< td=""><td>3.9</td><td>0.9<t< td=""><td>3.0</td><td>8.0</td><td>1.6cT</td><td>3.1</td><td>1.3<t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<></td></t<></td></t<></td></w<></td></t<></td></w<>	2.3 <t< td=""><td>0.4<w< td=""><td>26.9</td><td>4.7</td><td>1.8<t< td=""><td>3.9</td><td>0.9<t< td=""><td>3.0</td><td>8.0</td><td>1.6cT</td><td>3.1</td><td>1.3<t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<></td></t<></td></t<></td></w<></td></t<>	0.4 <w< td=""><td>26.9</td><td>4.7</td><td>1.8<t< td=""><td>3.9</td><td>0.9<t< td=""><td>3.0</td><td>8.0</td><td>1.6cT</td><td>3.1</td><td>1.3<t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<></td></t<></td></t<></td></w<>	26.9	4.7	1.8 <t< td=""><td>3.9</td><td>0.9<t< td=""><td>3.0</td><td>8.0</td><td>1.6cT</td><td>3.1</td><td>1.3<t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<></td></t<></td></t<>	3.9	0.9 <t< td=""><td>3.0</td><td>8.0</td><td>1.6cT</td><td>3.1</td><td>1.3<t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<></td></t<>	3.0	8.0	1.6cT	3.1	1.3 <t< td=""><td>5.3</td><td>T&gt;9.1</td><td></td></t<>	5.3	T>9.1	
		Turbidity	FTU	7	17	171	06-1	3.40	2.50	3.37	1,24	3.40	2.80	1 16	4.80	2.10	2.60	1.51	2 10	3 10	2.40	2.30	1.59	1.33	1.23	1.25	01.1	1.15	1.45	1.15	6.50	1 00	2.70	1.34	1.55	1 26	77 1	00.1 CL 1	108	1.47	1.91	2	
		Hd a		7.92	7.88	200	7.00	7.86	7.60	7.81	7.95	7.88	7.93	7.95	7.88	767	7.60	7.59	7.53	7.91	7.98	7.97	7 95	7.94	7.96	8.04	8.01	8.04	2 98	8 04	7 49	7.93	7.99	7.88	7.87	7.74	7.95	7.88	7.96	2 96	7 92	7.91	
		Temperature	J.	8.01	:	: '	0.01	16.9	<u>}</u> :	10.8	:	17.0	16.8	16.2	:	17.0	2 1	;	:	17.0	16.9	16.9	;	16.4	9:91	6.91	16.7	16.8	167	16.7	;	16.9	16.7	16.3	1	: ;	8.91	1	16.8	16.7	163	1	
	Sampling	Date		June 28	June 27	June 29	Aug 22	Aug 22	70 guy	June 28	June 29	Aug. 22	Aug. 23	Aug. 24	June 27	June 29	June 27	June 27	June 29	Aug 22		Aug. 24		Aug 24			Aug 24			Aug. 23	June 29	Aug 22		Aug. 24	June 27		Aug 22	June 20	Aug 22	Aug. 23	Aug. 24		
П	Sample	Depth metres		5.0	0.5	: :	: 0	ć o	1.0	0.5	:	=	z	5.0	0 1	s :-	01	0.5	:	:	9 2	\$ 0	1.0		0 †	1.0	0	2.0	2	8.0	0.5	:	:	ī	8.0	0.5	: -	0.1		ī	z	1.0	1
c	n metres	CDN shore		100	160	. :	= 0	180	ŧ	300	=	2	:	200	=	220	Ξ	240	=	÷	250	300	2 =	=	=	350	: =	007	=	:	150	=	:	*	=	17.5	: :	000	707	=	=	5	 
Station	Distance in metres	WWTP C		500	*	1 :	; ;	: :	:	:	*	3	;	3	;	: :	;	3	*	÷	3 3	: :	:	7	:	: :	: :	3	;	÷	006	:	;	=	:	3		:	z	3	=	:	1 1 1 1
	Transect	(Station Number)		E (172)	:		= :		;	5	3	2	2	:	:	: :	3	:	=	:	3 3	: :	3	3	:	7 1	: :	ŧ	:	:	F (173)	*	3	3	:	:	: :	:	;	3	*	3	

N. Sharper   Sample Sample   Sample		Station	ion	1					ı				Pars	Parameter							
Name   Color   December   Decem	Transact	Distance	e in metres	Sample	Sampling																ı
No. 10   N	(Station Number)		CDN. shore	Depth metres	Date	Temperature		urbidity S	$\vdash$	Fecal coliforms	Escherichu coli	Pseud. aerugmosa		Chloride	Ammonia N	Un-ionized Ammonia	Total Kjeldahi N	Total Phosphorus	Phenolics	lron	Zinc
1, 2, 1, 1, 2, 1, 1, 2, 1, 2, 1, 3						٥.		FTU	7	org di	org dl <sup>1</sup>	org.dl	ıs.cm¹ @25°C	$\overline{}$	μ811	µg I	11.g.1	µ8.1	1-1 g//	μg.]·	μg.1
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	F(173)	006	200	1.5	Aug. 22	8.91	7.94	1 28	4.2	흵	88	22	76	1.5	74	7	240	0	21	170	2.1 <t< th=""></t<>
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1.0   1.0	: :	: :	:	-	Aug. 22	001	7 69	1.80	2.9	7	7	: 7	104 0	2.20	202	. }	420	7	13	92 <t< td=""><td>1.2<t< td=""></t<></td></t<>	1.2 <t< td=""></t<>
1.5   1.5	:	=	:	2.0	Aug 22	16.8	7.94	1.37	3.6	0901	740	18	0 86	1.50	80	2	230	Ξ	2	150	1.5 <t< td=""></t<>
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1.0	÷	:	:	=	Aug. 22	16.8	7.90	90'1	3.9	1210	880	13	0.86	1.60	87	ю	255	12	디	145	1.4 <t< td=""></t<>
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10	5	2	=	1.0	Aug 23	6.91	7.99	1.98	2.0 <t< td=""><td>16</td><td>9/</td><td><u>=</u></td><td>0 66</td><td>1.65</td><td>68</td><td>re,</td><td>230</td><td>- N- N-</td><td>67</td><td>1&gt;£6</td><td>154.</td></t<>	16	9/	<u>=</u>	0 66	1.65	68	re,	230	- N-	67	1>£6	154.
National Color   Nati	:	:	:	2.5	Aug 22	:	7.93	2-10	5.3	윘	S) :	oo v	0.86	1.60	08	; ‹	780	÷ 9	0 .	081	1.6<1
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1         Ang 21         161         291         145         990         170         84         3         200         84         170         84         3         200         170         84         3         200         84         170         84         3         200         84         170         84         950         170         84         3         200         84         170         84         3         200         84         170         84         3         200         84         170         84         3         200         84         170         84         3         200         84         170         84         3         200         84         170         84         950         170         170         80         170         84         170         80         170         80         170         80         170         80         170         80         170         80         170         80         170         80         170         80         170         80         170         80         170         80         170         80         170         80         170         80         170         80         170         80	1	:	300	10	Aug 23	17.0	7.96	1 90	1.8 <t< td=""><td>92</td><td>, 08</td><td>2 2</td><td>0.66</td><td>1 60</td><td>06</td><td>٤</td><td>240</td><td>8<t< td=""><td>26</td><td>T&gt;89</td><td>0.7<t< td=""></t<></td></t<></td></t<>	92	, 08	2 2	0.66	1 60	06	٤	240	8 <t< td=""><td>26</td><td>T&gt;89</td><td>0.7<t< td=""></t<></td></t<>	26	T>89	0.7 <t< td=""></t<>
3.0         14.5         Aug 21         16.7         73.9         4.5         Aug 21         16.7         73.9         4.5         4.6         7.0         4.5         7.0         4.5         7.0         4.5         7.0         4.6         7.0         4.6         7.0         4.6         7.0         4.6         7.0         4.6         7.0         1.0         4.2         1.0         4.6         1.0         4.6         7.0         1.0         4.6         1.0         4.6         7.0         1.0         4.6         1.0         6.0         1.0         4.6         1.0         6.0         1.0         4.6         1.0         4.6         7.0         1.0         4.6         1.0         1.0         4.6         1.0         1.0         4.6         1.0         1.0         4.6         1.0         1.0         4.6         1.0         4.6         7.0         1.0         4.0         1.0         4.0	2	1		:	Aug. 24	16.1	7.91	1.35	2.6	87	24	7	086	1.70	700	м	230	8 <t< td=""><td>11.6</td><td>140</td><td>1.3<t< td=""></t<></td></t<>	11.6	140	1.3 <t< td=""></t<>
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100   100	:	:		8.0	Aug 24	991	7.91	1.04	3.3	07 :	7 5	7 5	0.79	05.1	36	·1	081	3<1	212	1 × 0× 0	1 20 7
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1700   100   0.5 Aug 21   16.7   8.04   10.9   15.5   16.7   8.04   10.9   15.5   16.7   10.9   16.7   16	; ;	: :	200	0.7	) June 27	;	7.01	26.0		: <del>-</del>	: -	: 2	95.0	9 9	5 Y	; =	951	7. T	0.6cT	33 <t< td=""><td>0.5cT</td></t<>	0.5cT
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1700   100   0.5   Aug 21   16.5   7.96   0.84   21c    8   8   2   9.00   140   28   1   150   4c    130   4c	:	2	=	÷	Aug 23	16.7	8 04	1.00	0.5 <t< td=""><td>20</td><td>20,</td><td>- 73</td><td>0.96</td><td>1 20</td><td>24</td><td>_</td><td>140</td><td>4<t< td=""><td>12</td><td>31<t< td=""><td>0.5<w< td=""></w<></td></t<></td></t<></td></t<>	20	20,	- 73	0.96	1 20	24	_	140	4 <t< td=""><td>12</td><td>31<t< td=""><td>0.5<w< td=""></w<></td></t<></td></t<>	12	31 <t< td=""><td>0.5<w< td=""></w<></td></t<>	0.5 <w< td=""></w<>
1700   100   05   Aug 21   164   802   138   2.6   644   52   2   970   140   60   2   200   847   112   1	;	2	;	:		16.5	7.96	0.84	2.1 <t< td=""><td>8</td><td>œ</td><td>۲,</td><td>0.96</td><td>1 40</td><td>28</td><td>-</td><td>150</td><td>1&gt;t</td><td>13.0</td><td>49<t< td=""><td>1 3<t< td=""></t<></td></t<></td></t<>	8	œ	۲,	0.96	1 40	28	-	150	1>t	13.0	49 <t< td=""><td>1 3<t< td=""></t<></td></t<>	1 3 <t< td=""></t<>
10 Aug 24   15.8   188   2.6   644   52   2   970   140   48   1   180   547   122   9347     1	H (174)	1700	001	\$ 0		16.7	7 91	0.38	3.7	196	901	32	0.76	1.40	09	2	200	% <t< td=""><td>∞ ۳.</td><td>110</td><td>1.3<t< td=""></t<></td></t<>	∞ ۳.	110	1.3 <t< td=""></t<>
" Aug 24         158         788         118         4.3         92         64         12         980         160         58         2         200         84T         122         934T           " 15         June 29         " 795         142         1647         20         20         4         980         160         34         " 170         84T         165         384T           " Aug 24         165         79         142         167         20         4         980         160         34         " 190         84T         166-7         384T           " Aug 24         163         790         113         41         96         52         6         980         160         34         190         84T         14         96         970         140         48         190         96         140         18         190         971         144         48         16         980         160         140         48         190         970         140         48         1         200         971         147         140         18         1         200         971         147         147         147         147         144	:	2 :	2 :	10		16.4	8.02	1 38	2.6	3	52	ر1	97.0	1.40	87	-	180	5 <t< td=""><td>1.2</td><td>70<t< td=""><td>0.8<t< td=""></t<></td></t<></td></t<>	1.2	70 <t< td=""><td>0.8<t< td=""></t<></td></t<>	0.8 <t< td=""></t<>
1.   1.5   June 29     7.95   1.42   1.6cT   2.0   2.0   4   98.0   1.60   34     170   2cT   0.6cT   53cT	2	*	:	. =	Aug 24	15.8	7.88	1 18	£.	92	64	12	0.86	09.1	58	2	200	8 <t< td=""><td>12.2</td><td>93<t< td=""><td>D 8<t< td=""></t<></td></t<></td></t<>	12.2	93 <t< td=""><td>D 8<t< td=""></t<></td></t<>	D 8 <t< td=""></t<>
u         2.5         June 27         -         793         105         0.5 <t< th="">         5         &lt;2         960         140         41         -         190         8<t< th="">         0.4<t< th="">         63         7           u         3         Aug. 21         16.7         795         142         37         12         164         16         22         1         20         8<t< td="">         14         130           u         3         Aug. 23         16.5         799         198         3.7         72         52         6         98.0         160         62         1.0         96         14         190         8<t< td="">         14         130           u         3.0         Aug. 23         16.5         79         1.8         36         2         98.0         1.60         62         1.0         108         109         98.7         1.0         108         100         1.0</t<></t<></t<></t<></t<>	=	4	=	1.5	June 29	;	7.95	1.42	1 6 <t< td=""><td>20</td><td>20</td><td>7</td><td>086</td><td>1.60</td><td>34</td><td>;</td><td>170</td><td>2<t< td=""><td>0.6<t< td=""><td>53<t< td=""><td>D.9<t< td=""></t<></td></t<></td></t<></td></t<></td></t<>	20	20	7	086	1.60	34	;	170	2 <t< td=""><td>0.6<t< td=""><td>53<t< td=""><td>D.9<t< td=""></t<></td></t<></td></t<></td></t<>	0.6 <t< td=""><td>53<t< td=""><td>D.9<t< td=""></t<></td></t<></td></t<>	53 <t< td=""><td>D.9<t< td=""></t<></td></t<>	D.9 <t< td=""></t<>
10	:	=	:	2.5	June 27	1	7 93	1.05	0.5 <t< td=""><td>٧.</td><td>~</td><td>₹</td><td>0'96</td><td>0+:1</td><td><del>-</del></td><td>-</td><td>190</td><td>1&gt;8</td><td>1&gt;t 0</td><td>63<t< td=""><td>0.8<t< td=""></t<></td></t<></td></t<>	٧.	~	₹	0'96	0+:1	<del>-</del>	-	190	1>8	1>t 0	63 <t< td=""><td>0.8<t< td=""></t<></td></t<>	0.8 <t< td=""></t<>
3.0     Aug. 23     16.5     79.0     14.0     48     1     208     94.7     129     105       4     2     98.0     18.0     2     98.0     18.0     4     1     200     24.7     105       5.0     June 29     -     7.81     0.90     0.34     4     4     4     2     98.0     18.0     62     -     200     24.7     10     794       4     4     4     4     4     4     4     2     98.0     18.0     62     -     200     24.7     10     794       5     10.5     June 27     -     7.78     1.00     0.64     8     8     2     98.0     120     34     -     160     8     8     1     98.0     120     34     -     160     8     1     10     794       5     1	: :	: :	: :	: 0	Aug 22	16.7	7 95	1 42	3.7	<u>2</u>	픠	91 4	97.0	1.50	1 E	~1 -	200	× 5	<u> </u>	9 9	1.5<1 7.2 <t< td=""></t<>
"         5 0         June 29         "         7.94         0.97         1.8         4         36         2         98.0         180         62         "         200         2 <t< th="">         1.0         79           "         "         "         7.9         0.3         4         4         2         98.0         120         34         "         160         8         8         7         96.0         120         34         "         160         8         8         7         96.0         120         34         "         160         8         8         7         96.0         120         34         "         160         8         8         4         95.0         1.40         8         7         0.2         4         4         4         4         4         95.0         1.40         8         7         0.0         1.40         8         7         0.0         1.40         8         7         0.0         1.40         8         7         0.2         1.40         8         1         0.2         1         0.2         1         0.2         1         1         0.2         1         0.2         1         1</t<>	=	:	=	0.5	Aug. 24	5.01	7 99	26.1	3.7	5,00	5.5	· ·	97.0	06.1	1 2		208	T>6	12	105	
"         "         10.5         June 27         "         7.81         0.90         0.34W         4         <4         2         96.0         120         34         "         160         8cT         63cT         0.3cT         4dcT           "         200         2.5         June 27         -         7.78         1.00         0.6cT         8         8         2         95.0         0.90cT         18         -         150         5cT         0.2cT         4dcT           "         "         June 29         10.2         7.96         0.92         11cT         8         8         4         95.0         1.40         8cT         0.1         120         2cT         0.2cT         4dcT           "         "         Aug. 24         1.66         8.04         0.95         0.4cW         28         24         96.0         1.30         38         1         1.6         40cT           "         "         "         3.0         Aug. 24         1.6.4         7.97         0.77         2.4cT         56         3.2         4         97.0         1.40         60         2         1.50         3cT         1.6         3cT         1.5 <th>:</th> <td>:</td> <td>:</td> <td>0 5</td> <td>June 29</td> <td>;</td> <td>7.94</td> <td>0.97</td> <td>1.8<t< td=""><td>2 9</td><td>36</td><td>ر1</td><td>0.86</td><td>1 80</td><td>62</td><td></td><td>200</td><td>2<t< td=""><td>0.</td><td>79<t< td=""><td>1 6<t< td=""></t<></td></t<></td></t<></td></t<></td>	:	:	:	0 5	June 29	;	7.94	0.97	1.8 <t< td=""><td>2 9</td><td>36</td><td>ر1</td><td>0.86</td><td>1 80</td><td>62</td><td></td><td>200</td><td>2<t< td=""><td>0.</td><td>79<t< td=""><td>1 6<t< td=""></t<></td></t<></td></t<></td></t<>	2 9	36	ر1	0.86	1 80	62		200	2 <t< td=""><td>0.</td><td>79<t< td=""><td>1 6<t< td=""></t<></td></t<></td></t<>	0.	79 <t< td=""><td>1 6<t< td=""></t<></td></t<>	1 6 <t< td=""></t<>
" 200 2.5 June 27 7.78 1.00 0.6 <t 0.2<t="" 0.90<t="" 1="" 150="" 18="" 1<="" 2="" 44-t="" 5<t="" 8="" 95.0="" td=""><th>:</th><td>5</td><td>=</td><td>10.5</td><td>June 27</td><td>1</td><td>7.81</td><td>06.0</td><td>0.3<w< td=""><td>77</td><td><b>∵</b></td><td>۲3</td><td>0.96</td><td>1 20</td><td>34</td><td>;</td><td>160</td><td>8<t< td=""><td>0.8<t< td=""><td>63<t< td=""><td>0.5<w< td=""></w<></td></t<></td></t<></td></t<></td></w<></td></t>	:	5	=	10.5	June 27	1	7.81	06.0	0.3 <w< td=""><td>77</td><td><b>∵</b></td><td>۲3</td><td>0.96</td><td>1 20</td><td>34</td><td>;</td><td>160</td><td>8<t< td=""><td>0.8<t< td=""><td>63<t< td=""><td>0.5<w< td=""></w<></td></t<></td></t<></td></t<></td></w<>	77	<b>∵</b>	۲3	0.96	1 20	34	;	160	8 <t< td=""><td>0.8<t< td=""><td>63<t< td=""><td>0.5<w< td=""></w<></td></t<></td></t<></td></t<>	0.8 <t< td=""><td>63<t< td=""><td>0.5<w< td=""></w<></td></t<></td></t<>	63 <t< td=""><td>0.5<w< td=""></w<></td></t<>	0.5 <w< td=""></w<>
" " " June 29 102 7.96 0.92 11cT 8 8 4 95.0 1.40 8cT 0.1 120 2cT 38cT 38cT   " 3.0 Aug 22 16.7 8.00 1.03 2.4cT 268 180 8 97.0 1.30 38 1 15.0 4cT 78cT   " " Aug 24 16.4 797 0.77 2.4cT 56 3.2 4 97.0 1.40 60 2 15.0 3cT 1.6 38cT   " " 3.0 Aug 24 16.4 797 0.77 2.4cT 56 3.2 4 97.0 1.40 60 2 15.0 3cT 1.6 38cT	:	;	200	2.5	June 27	;	7.78	1.00	D.6 <t< td=""><td><b>9</b>0</td><td><b>~</b></td><td>C1</td><td>950</td><td>0.90<t< td=""><td>18</td><td>1</td><td>150</td><td>5<t< td=""><td>0.2<t< td=""><td>44<t< td=""><td>0.5<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	<b>9</b> 0	<b>~</b>	C1	950	0.90 <t< td=""><td>18</td><td>1</td><td>150</td><td>5<t< td=""><td>0.2<t< td=""><td>44<t< td=""><td>0.5<t< td=""></t<></td></t<></td></t<></td></t<></td></t<>	18	1	150	5 <t< td=""><td>0.2<t< td=""><td>44<t< td=""><td>0.5<t< td=""></t<></td></t<></td></t<></td></t<>	0.2 <t< td=""><td>44<t< td=""><td>0.5<t< td=""></t<></td></t<></td></t<>	44 <t< td=""><td>0.5<t< td=""></t<></td></t<>	0.5 <t< td=""></t<>
3.0 Aug. 22 16.7 8.00 1.03 2.4<7 268 180 8 97.0 1.30 38 1 150 4<7 10<1 78<1 10<1 78<1 10<1 78<1 10<1 78<1 10<1 78<1 10<1 78<1 10<1 78<1 10<1 78<1 10<1 79<1 10<1 79<1 79<1 79<1 79<1 79<1 70<1 70<1 1.40 60 24 1 10<1 70<1 70<1 70<1 70<1 70<1 70<1 70	:	;	=	:	June 29	10.2	96''	0.92	11 <t< td=""><td>×</td><td>×</td><td>7</td><td>0.56</td><td>1.40</td><td>8<t< td=""><td>0.1</td><td>120</td><td>2<t< td=""><td>0.2<t< td=""><td>38<t< td=""><td>0.8<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	×	×	7	0.56	1.40	8 <t< td=""><td>0.1</td><td>120</td><td>2<t< td=""><td>0.2<t< td=""><td>38<t< td=""><td>0.8<t< td=""></t<></td></t<></td></t<></td></t<></td></t<>	0.1	120	2 <t< td=""><td>0.2<t< td=""><td>38<t< td=""><td>0.8<t< td=""></t<></td></t<></td></t<></td></t<>	0.2 <t< td=""><td>38<t< td=""><td>0.8<t< td=""></t<></td></t<></td></t<>	38 <t< td=""><td>0.8<t< td=""></t<></td></t<>	0.8 <t< td=""></t<>
	:	ŧ	= -	3.0	Aug. 22	16.7	8.00	1.03	2.4 <t< td=""><td><u>5</u></td><td><u>@</u> ;</td><td>∞ '</td><td>97.0</td><td>1.30</td><td>∞ ÷</td><td></td><td>150</td><td>1 × 1</td><td>10&lt;1</td><td>18&lt;1</td><td>0.7&lt;1</td></t<>	<u>5</u>	<u>@</u>  ;	∞ '	97.0	1.30	∞ ÷		150	1 × 1	10<1	18<1	0.7<1
30 Aug 24 16.4 797 077 2.4<1 36 3.2 4 97.0 1.40 00 2 130 3<1	:		: :	=	Aug. 23	9.91	8 04	0.95	0.4 <w< td=""><td>87 7</td><td>L</td><td>♡ .</td><td>0.96</td><td>0.30</td><td>77.</td><td><b>-</b> (</td><td>071</td><td>Ž,</td><td>2 2</td><td>1&gt;0+</td><td>W&gt;C.U</td></w<>	87 7	L	♡ .	0.96	0.30	77.	<b>-</b> (	071	Ž,	2 2	1>0+	W>C.U
	=	=	:	3.0	Aug 24	16.4	7 97	0.77	2.4 <t< td=""><td>26</td><td>55</td><td>-1</td><td>97.0</td><td>07</td><td>3</td><td>7</td><td>061</td><td>¥.</td><td>의</td><td>38&lt;1</td><td>0.9&lt;1</td></t<>	26	55	-1	97.0	07	3	7	061	¥.	의	38<1	0.9<1
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	Cention	100										Para	Parameter							
	Distance	Distance in metres																		
Transect (Station		from CDN shore	Sample Depth	Sampling Date	Temperature	PH T	Turbidity S	Susp.Solids	Fecal	chia	Pseud.	Conductivity Chloride Ammonia N	Chloride ,	Ammonia N	Un-ionized	Total Kieldahl N	Total	Phenolics	Iron	Zinc
Number)	outfalls		mentes		j.		FITU	"I.gm	org.dl '	org.dl <sup>-1</sup>	aeragmosa org.di	as cm.º @25°C	=	μg.1 <sup>1</sup>	μg.1 <sup>+</sup>	μg.l.	1.8×1	μg.1-1	μg.l.¹	μg.I.
H (174)	1700	200	5.6	June 27	1	7.77	1.10	1 4 <t< th=""><th>×</th><th>7</th><th>2</th><th>0.26</th><th>1.00</th><th><u>81</u></th><th>1</th><th>200</th><th>8<t< th=""><th>T&gt;9.0</th><th>196<t< th=""><th>0.5<w< th=""></w<></th></t<></th></t<></th></t<>	×	7	2	0.26	1.00	<u>81</u>	1	200	8 <t< th=""><th>T&gt;9.0</th><th>196<t< th=""><th>0.5<w< th=""></w<></th></t<></th></t<>	T>9.0	196 <t< th=""><th>0.5<w< th=""></w<></th></t<>	0.5 <w< th=""></w<>
"	3	=	10 0	June 29	;	7.93	66.0	1.2 <t< td=""><td>16</td><td>12</td><td>7&gt;</td><td>0 5 6</td><td>1.40</td><td>01</td><td>: -</td><td>120</td><td>2<t< td=""><td>0.2<t< td=""><td>38<t< td=""><td>1&gt;8.0</td></t<></td></t<></td></t<></td></t<>	16	12	7>	0 5 6	1.40	01	: -	120	2 <t< td=""><td>0.2<t< td=""><td>38<t< td=""><td>1&gt;8.0</td></t<></td></t<></td></t<>	0.2 <t< td=""><td>38<t< td=""><td>1&gt;8.0</td></t<></td></t<>	38 <t< td=""><td>1&gt;8.0</td></t<>	1>8.0
:	=	=	12.0	Aug 22	166	8.03	1.19	2.3 <t< td=""><td>28</td><td>24</td><td>01</td><td>96.0</td><td>1.30</td><td>97 7</td><td></td><td>07.</td><td>Ž į</td><td><u> </u></td><td>00&lt;1</td><td>1.0&lt;1</td></t<>	28	24	01	96.0	1.30	97 7		07.	Ž į	<u> </u>	00<1	1.0<1
:	=	:	=	Aug 23	16.5	8.05	1.13	1.5 <t< td=""><td>7 :</td><td>24</td><td>· · ·</td><td>0.96</td><td>30</td><td>7 8</td><td><b>-</b> -</td><td>0+1</td><td>- <del>-</del> -</td><td>2  2</td><td></td><td>0.5cW</td></t<>	7 :	24	· · ·	0.96	30	7 8	<b>-</b> -	0+1	- <del>-</del> -	2  2		0.5cW
:	ž	:	:	Aug. 24	8.91	7.95	1.00	2.6	28	24	7,	96.0	0+1	30	-	000		9 9	17.1	0.7cT
	;	300	2.0	June 27	;	7.77	1.20	1.7 <t< td=""><td><b>寸</b>:</td><td>₹∶</td><td>٠, ١</td><td>95.0</td><td>3 5</td><td><u>s</u> :</td><td>۱ 5</td><td>207</td><td>0&lt;1</td><td>0.7 T/C</td><td>17/1</td><td>127.0</td></t<>	<b>寸</b> :	₹∶	٠, ١	95.0	3 5	<u>s</u> :	۱ 5	207	0<1	0.7 T/C	17/1	127.0
		:	:	June 29	10.4	7.85	0.91		13	Ξ	\$	95.0	0+.1	71	1.0	<u>0+</u> .	1>7	770	17/5	17.70 W 30
:	:	2	:	Aug 22	16.7	8.00	1.15	1.4 <t< td=""><td>1.2</td><td>12</td><td>-+</td><td>0.96</td><td>1 20</td><td>22</td><td><u> </u></td><td>0+1</td><td>Ž.</td><td>기:</td><td>156</td><td>0.5<w< td=""></w<></td></t<>	1.2	12	-+	0.96	1 20	22	<u> </u>	0+1	Ž.	기:	156	0.5 <w< td=""></w<>
:	ā	£	:	Aug. 23	9:91	8.02	1.02	1.I <t< td=""><td>₹</td><td><b>7</b></td><td>77</td><td>0.96</td><td>1.30</td><td>26</td><td>_</td><td>150</td><td><del>-</del></td><td><u>=</u> 2</td><td>1&gt;+0</td><td>W&gt;C.U</td></t<>	₹	<b>7</b>	77	0.96	1.30	26	_	150	<del>-</del>	<u>=</u>  2	1>+0	W>C.U
:	:	:	:	Aug. 24	16.5	7.94	0.74	2 0 <t< td=""><td>20</td><td>91</td><td>&lt;2</td><td>0.76</td><td>0<del>7</del> –</td><td>30</td><td>_</td><td>051</td><td></td><td>77</td><td>55&lt;1</td><td>0.5<w< td=""></w<></td></t<>	20	91	<2	0.76	0 <del>7</del> –	30	_	051		77	55<1	0.5 <w< td=""></w<>
:	3	;	7.0	June 27	1	7.76	1.20	2.9	₹	₹	Ç	95.0	01.1	<del>-</del> -	;	160	I>/	71	36<1	0 0<1
;	:	:	-	June 29	10.0	7.92	0.77	0.4 <w< td=""><td>10</td><td>€&gt;</td><td>4</td><td>95.0</td><td>1.40</td><td>10</td><td>0.1</td><td>120</td><td>2<t< td=""><td>0.2<t< td=""><td>1&gt;0+</td><td>0.6&lt;1</td></t<></td></t<></td></w<>	10	€>	4	95.0	1.40	10	0.1	120	2 <t< td=""><td>0.2<t< td=""><td>1&gt;0+</td><td>0.6&lt;1</td></t<></td></t<>	0.2 <t< td=""><td>1&gt;0+</td><td>0.6&lt;1</td></t<>	1>0+	0.6<1
:	z	Ξ	8 0	Aug. 23	16.5	8.03	1.64	2.2 <t< td=""><td>16</td><td>12</td><td>00</td><td>0.96</td><td>1 40</td><td>26</td><td>_</td><td>150</td><td><b>∓</b></td><td>9 </td><td>80<t< td=""><td>0.6<t< td=""></t<></td></t<></td></t<>	16	12	00	0.96	1 40	26	_	150	<b>∓</b>	9	80 <t< td=""><td>0.6<t< td=""></t<></td></t<>	0.6 <t< td=""></t<>
:	5	=	2	Aug. 24	16.5	7.95	0.81	2.2 <t< td=""><td>28</td><td>28</td><td>&lt;2</td><td>0 96</td><td>1.40</td><td>22</td><td>_</td><td>140</td><td>T&gt;+</td><td>17.8</td><td>18<t< td=""><td>0.5<w< td=""></w<></td></t<></td></t<>	28	28	<2	0 96	1.40	22	_	140	T>+	17.8	18 <t< td=""><td>0.5<w< td=""></w<></td></t<>	0.5 <w< td=""></w<>
:	=	:	0	Ane 22	999	7 98	0.72	2.5 <t< td=""><td>91</td><td>16</td><td>∞</td><td>096</td><td>1 20</td><td>20</td><td>-</td><td>140</td><td>T&gt;9</td><td>1.2</td><td>130</td><td>0.8<t< td=""></t<></td></t<>	91	16	∞	096	1 20	20	-	140	T>9	1.2	130	0.8 <t< td=""></t<>
: :	=	900	10		8 01	7.84	0.87	0.7 <t< td=""><td>₹</td><td>. ↑</td><td>&lt;2</td><td>950</td><td>1 40</td><td>12</td><td>0.1</td><td>150</td><td>2<t< td=""><td>0 6<t< td=""><td>50<t< td=""><td>D&gt;9.0</td></t<></td></t<></td></t<></td></t<>	₹	. ↑	<2	950	1 40	12	0.1	150	2 <t< td=""><td>0 6<t< td=""><td>50<t< td=""><td>D&gt;9.0</td></t<></td></t<></td></t<>	0 6 <t< td=""><td>50<t< td=""><td>D&gt;9.0</td></t<></td></t<>	50 <t< td=""><td>D&gt;9.0</td></t<>	D>9.0
: :	:	00;	<u> </u>	Aug 22	8.91	8 00	1 15	3.3	30	16	2	0.96	1 20	22	-	140	4 <t< td=""><td><u>~</u> </td><td>73<t< td=""><td>0.5<w< td=""></w<></td></t<></td></t<>	<u>~</u>	73 <t< td=""><td>0.5<w< td=""></w<></td></t<>	0.5 <w< td=""></w<>
	: :		:		16.6	200	890	T/7	07	07	<2	096	0+1	56	-	140	<del>1</del> > <del>1</del>	1.4	38 <t< td=""><td>0.5<w< td=""></w<></td></t<>	0.5 <w< td=""></w<>
;	: :	: :		Aug. 23	100	10.0	0.00	T/4-	3.2	5.0	,	0.96	07	20	_	140	4 <t< td=""><td>7.4</td><td>30<t< td=""><td>0.5<w< td=""></w<></td></t<></td></t<>	7.4	30 <t< td=""><td>0.5<w< td=""></w<></td></t<>	0.5 <w< td=""></w<>
:	Ξ	: :	: !	Ang. 24	16.6	+6.7	0.70	1.5C.	7. 0	† o	۱ ر	050	1.60	3 =	٠ ;	150	T>9	0.6 <t< th=""><th>16<t< th=""><th>0.9<t< th=""></t<></th></t<></th></t<>	16 <t< th=""><th>0.9<t< th=""></t<></th></t<>	0.9 <t< th=""></t<>
:	:	Ξ	1.5	June 27	:	(82	06.0	1>4.1	0	o	,	0.00	3	-		•				
	1700	080	2 6	7C ann	;	7 91	1.30	0.8 <t< td=""><td>20</td><td>20</td><td>7</td><td>0.96</td><td>1 10</td><td>26</td><td>1</td><td>180</td><td>X<t< td=""><td>0 8<t< td=""><td>50<t< td=""><td>1.2<t< td=""></t<></td></t<></td></t<></td></t<></td></t<>	20	20	7	0.96	1 10	26	1	180	X <t< td=""><td>0 8<t< td=""><td>50<t< td=""><td>1.2<t< td=""></t<></td></t<></td></t<></td></t<>	0 8 <t< td=""><td>50<t< td=""><td>1.2<t< td=""></t<></td></t<></td></t<>	50 <t< td=""><td>1.2<t< td=""></t<></td></t<>	1.2 <t< td=""></t<>
(+c) 7	3 :	007	1 -	7110 77	17.0	7.97	0.74	2 3 <t< td=""><td>767</td><td>332</td><td>12</td><td>97.0</td><td>1 45</td><td>41</td><td>-</td><td>160</td><td>T&gt;9</td><td>21</td><td>76<t< td=""><td>0.8<t< td=""></t<></td></t<></td></t<>	767	332	12	97.0	1 45	41	-	160	T>9	21	76 <t< td=""><td>0.8<t< td=""></t<></td></t<>	0.8 <t< td=""></t<>
: :	: :	370	0:	Aug. 22	17.0	707	1.63	2,6	18	228	: =	97.0	1.50	64	C1	200	Ξ	]=	7>//	0.9 <t< td=""></t<>
: :	: :	;	:	Aug. 43	16.6	781	101	2.7	17	77	, C	0.86	1 60	58	2	210	7 <t< td=""><td>15.0</td><td>63<t< td=""><td>0.5<w< td=""></w<></td></t<></td></t<>	15.0	63 <t< td=""><td>0.5<w< td=""></w<></td></t<>	0.5 <w< td=""></w<>
		I	0	Aug 23	16.5	7 97	1 88	3.7	272	220	. 00	086	1 50	62	2	220	9 <t< td=""><td>낔</td><td>140</td><td>1.2<t< td=""></t<></td></t<>	낔	140	1.2 <t< td=""></t<>
:	5	001	· -	Ang 74	7 4 9	7.83	1.29	7	156	96	7	0.86	1.60	25	2	200	7 <t< th=""><th>8:</th><th>81<t< th=""><th>T&gt;90</th></t<></th></t<>	8:	81 <t< th=""><th>T&gt;90</th></t<>	T>90
:	=	:	- 0	Ang 22	17.0	7.96	1.08	2.6	780	428	5	97.0	1.40	0+	-	160	6 <t< th=""><th>0 8<t< th=""><th>74<t< th=""><th>0.8<t< th=""></t<></th></t<></th></t<></th></t<>	0 8 <t< th=""><th>74<t< th=""><th>0.8<t< th=""></t<></th></t<></th></t<>	74 <t< th=""><th>0.8<t< th=""></t<></th></t<>	0.8 <t< th=""></t<>
:	=	;	3 -	Aug. 23	16.4	7.99	2.00	2.6	<u>  8</u>	[2]	32	0.86	1 50	62	C1	200	7 <t< th=""><th>9 </th><th>8I<t< th=""><th>T&gt;0.1</th></t<></th></t<>	9	8I <t< th=""><th>T&gt;0.1</th></t<>	T>0.1
*	:	=	5.0	June 27	,	7.93	06.0	0.3 <w< th=""><th>54</th><th>91</th><th>7</th><th>95.0</th><th>1.10</th><th>32</th><th>;</th><th>170</th><th>6<t< th=""><th>T&gt;9.0</th><th>24&lt;1</th><th>1&gt;9.0</th></t<></th></w<>	54	91	7	95.0	1.10	32	;	170	6 <t< th=""><th>T&gt;9.0</th><th>24&lt;1</th><th>1&gt;9.0</th></t<>	T>9.0	24<1	1>9.0
;	;	:	8.0	Aug. 23	16.5	7.98	1.49	3.7	140	911	91	0.86	1.50	28	2	190	12	1.0	07 7	1.2<1
:	:	059			16.5	8.03	0.80	0.5 <t< th=""><th>09</th><th>7</th><th>7</th><th>0.96</th><th>1.30</th><th>28</th><th>-</th><th>140</th><th>3<t< th=""><th>1 0<t< th=""><th>36&lt;1</th><th>0.5<w< th=""></w<></th></t<></th></t<></th></t<>	09	7	7	0.96	1.30	28	-	140	3 <t< th=""><th>1 0<t< th=""><th>36&lt;1</th><th>0.5<w< th=""></w<></th></t<></th></t<>	1 0 <t< th=""><th>36&lt;1</th><th>0.5<w< th=""></w<></th></t<>	36<1	0.5 <w< th=""></w<>
:	=	2	=	Aug. 24	16.5	7.94	0.72	2.6	77	28	4	0.96	1.40	22	-	150	<del>1</del> <del>1</del> <del>1</del>	<u></u>	39 <t< th=""><th>0.5<w< th=""></w<></th></t<>	0.5 <w< th=""></w<>
	3	ı	4		16.8	8.00	1.20	2.5	36	36	8	0.96	1.30	54	-	130	Ţ> <del>†</del>	绀	70 <t< th=""><th>0.5<w< th=""></w<></th></t<>	0.5 <w< th=""></w<>
:	:	:	1	1110 27	5 :	7 94	00		17	च	<2	95.0	1.20	20	:	160	8 <t< th=""><th>D-99.0</th><th>48<t< th=""><th>1&gt;6.0</th></t<></th></t<>	D-99.0	48 <t< th=""><th>1&gt;6.0</th></t<>	1>6.0
;	5	:	2.4	Ang 23	16.5	8 03	1.15	2.0 <t< th=""><th>38</th><th>28</th><th>00</th><th>096</th><th>1.30</th><th>28</th><th>-</th><th>155</th><th>5<t< th=""><th>1.1<t< th=""><th>E8<t< th=""><th>0.5<w< th=""></w<></th></t<></th></t<></th></t<></th></t<>	38	28	00	096	1.30	28	-	155	5 <t< th=""><th>1.1<t< th=""><th>E8<t< th=""><th>0.5<w< th=""></w<></th></t<></th></t<></th></t<>	1.1 <t< th=""><th>E8<t< th=""><th>0.5<w< th=""></w<></th></t<></th></t<>	E8 <t< th=""><th>0.5<w< th=""></w<></th></t<>	0.5 <w< th=""></w<>
			1.0																	
Minimum Reportable Value	Prographe V	/alue			,	00.0	0.05	0.3	;	  - 	;	1.0	0.20	2	1	20	73	0.2	10	0.5
PWO Objective/Guideline	trve/Guidel:	ine			:	>6.5-	:	:	(100)	100	:	;	;	;	20	;	30	_	300	30
,					_	<8.5													300	30
GLWQA Objective	bjective				:	<6.5-	:	;	ı	I	ı	I	ı	1	ı	ı	ı	ı	305	2,
						63.0														

upstr = upstream; downstr.= downstream
"..." = not available; "..." approximately ".<"= less than; "..." = greater than
".<T" = a measurable trace amount; interpret with caution; ".<W" = no measurable response (zero); less than reported value
Underlined values in shaded cells exceed PWQ (OMOE, 1984) or GLWQA (UC, 1988) objective or guideline.

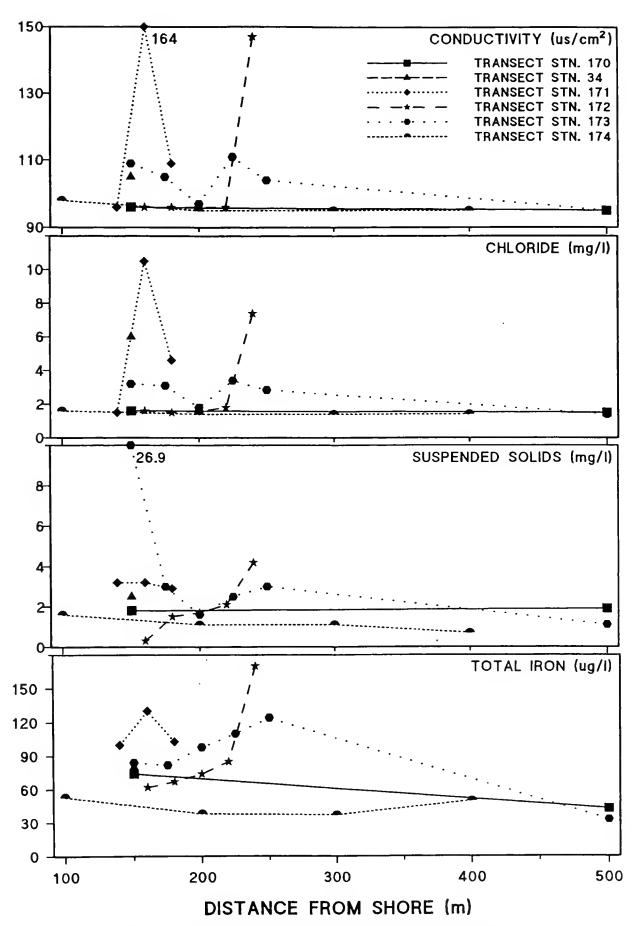


Figure 9. Cross-sectional distribution of conductivity, chloride, suspended solids and iron in Lake George Channel surface waters on June 29, 1989.

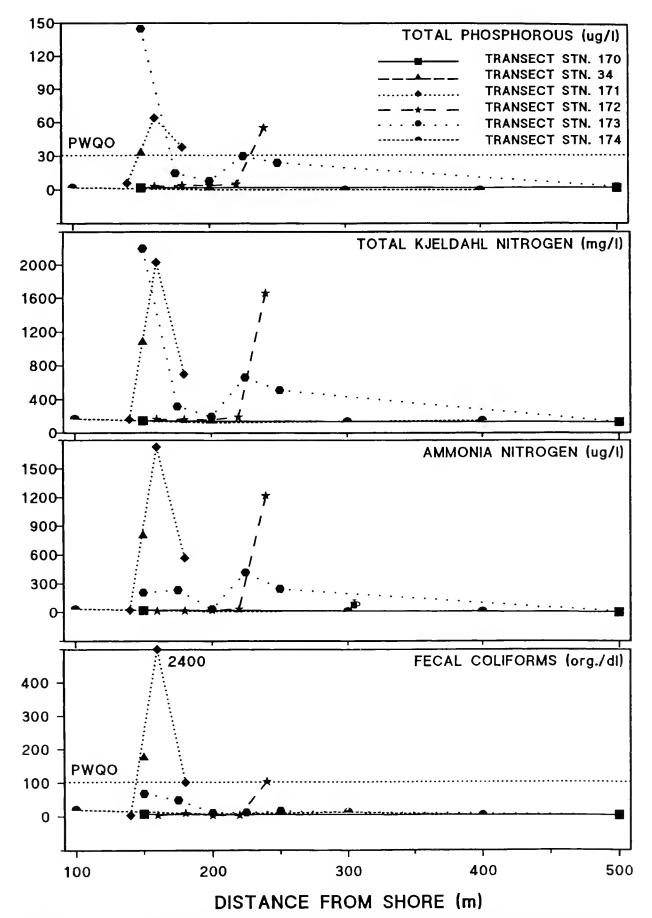


Figure 10. Cross-sectional distribution of total phosphorus, total Kjeldahl nitrogen, ammonia nitrogen and fecal coliform bacteria in Lake George Channel surface waters on June 29, 1989.

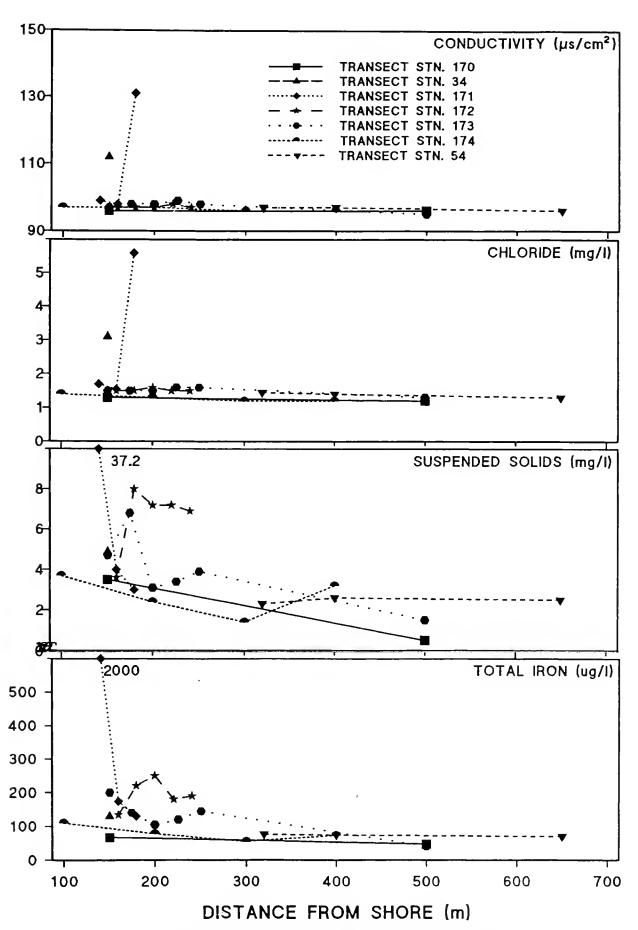


Figure 11. Cross-sectional distribution of conductivity, chloride, suspended solids and iron in Lake George Channel surface waters on August 22, 1989.

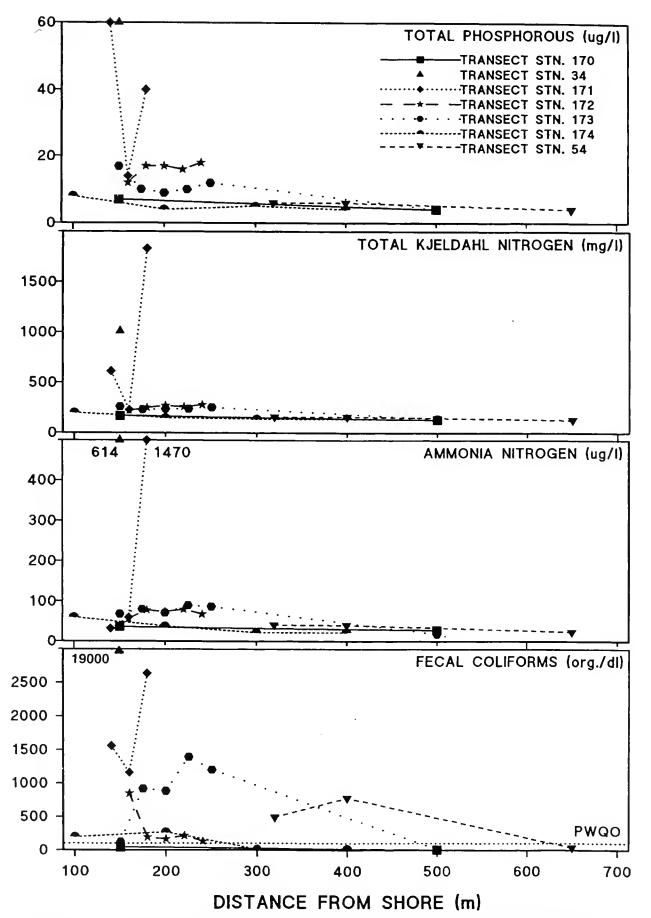


Figure 12. Cross-sectional distribution of total phosphorus, total Kjeldahl nitrogen, ammonia nitrogen and fecal coliform bacteria in Lake George Channel surface waters on August 22, 1989.

## 5.2.4 Surficial Sediment Quality

Visual descriptions indicate that surficial (upper 3 cm) sediments collected in the Lake George Channel and in Little Lake George were generally very organic in nature (i.e., "oozy"), often with a sewage or oily odour. All samples had an oily sheen (Table 5).

Particle size distribution analysis showed that sediments at a high proportion of the stations were of a sandy-silt or silty-sand composition, and sediments from the inshore stations in the Lake George Channel usually had more than 50% of their particle size distribution in the silt-clay (<62 µm diameter) fraction. Samples from further offshore, where the current is somewhat greater, often had somewhat less silt-clay content (Table 5; Fig. 13).

Analysis of samples for bacteria was complicated by the need for dilution, and this raised the detection limits for organisms. In general, however, sediments from up to 2 km downstream of the WWTP discharge (as far as Transect I/Station 176) contained elevated densities (relative to Transect B) of fecal coliform, *E. coli* and faecal *Streptococcus* bacteria. Densities of these organisms reached as high as about 134,000, 14,400 and 21,000 organisms per kg of wet sediment, respectively (Table 6).

Concentrations of nutrients and persistent inorganic contaminants (e.g., heavy metals) usually increased downstream of the WWTP discharge (compare stations on Transects C and E in Table 7 and Figs. 13 and 14). Also, concentrations were often higher at inshore stations than at offshore stations. Correlation analysis (Appendix Table A-9) indicated that concentrations of arsenic, cyanide, heavy metals and many of the individual PAH compounds correlated significantly (p < 0.05) with one another r = 0.50 to 1.0), suggesting a common (i.e., upstream) source. Sediment moisture content and loss on ignition (LOI) also correlated significantly with many of these contaminants. In contrast, the proportion of silt and clay (i.e., "fines") in sediments or of TOC content correlated significantly with only a few of the persistent contaminants (arsenic, cyanide, cadmium) and with total Kjeldahl nitrogen or total phosphorus. Solvent extractable (oils and greases) levels only correlated significantly with TOC content. Consequently, concentrations of the persistent contaminants plotted in Figures 13 and 14 were not normalized to TOC or percent fines.

Concentrations of many of the contaminants exceeded sediment quality guidelines for the protection of benthic organisms (Persaud *et al.*, 1993) at a number of the sampling locations. Stations with a large number of parameters exceeding these guidelines included those on Transects C, E, F, G, H, L (Stations 34, 172, 173, 175, 174 and 54) in Lake George Channel and Station 87 in Little Lake George, as well as the upstream reference, Transect B (Station 170). This indicates that upstream sources contribute or have contributed to sediment quality problems in the Lake George Channel and in Little Lake George.

Some of the samples from the stations noted in the previous paragraph also contained concentrations exceeding the Provincial Sediment Quality Guidelines "Lowest Effect Level" (LEL) for arsenic (6 mg.kg<sup>-1</sup>, or ppm), cadmium (0.60 mg.kg<sup>-1</sup>), chromium (26 mg.kg<sup>-1</sup>), copper (16 mg.kg<sup>-1</sup>), iron (20,000 mg.kg<sup>-1</sup>), lead (31 mg.kg<sup>-1</sup>), manganese (460 mg.kg<sup>-1</sup>), mercury (0.2 mg.kg<sup>-1</sup>), nickel (16 mg.kg<sup>-1</sup>) and zinc (120 mg.kg<sup>-1</sup>). In addition, concentrations of available cyanide at these stations exceeded the Provincial guideline of 0.1 mg.kg<sup>-1</sup> for Open Water

Table 5. Characteristics of Lake George Channel and Little Lake George surficial sediments.

S	Station		Visual & Olfa	Visual & Olfactory Description				Particle Size Distribution	011		
Transect	Metres from Canadian shore	Type	Plants?	Detritus?	Oily?	Odour	Coarse Sand (2000- 1000 µm)	Sand (999-63 µm)	Silt & Clay ( $<$ 62 $\mu$ m)	Moisture	Density
				ŀ			%	%	%	%	g cm i
B (170)	150	00026	> 1		√ (very)	sewage	0 10	7460	25 18	38.0	1.521
5	200	azoo	>		>	occurso deile	0000	20.00	11 00	13.0	5
C (34)	081	ooze over sandy tayer				siigiii sewage	0.20	06.97	77.97	0.54	Č.
E (172)	150 300	ooze over sandy layer black ooze	>	>>	√ (very) √ (very)	slight sewage oily	0.10	44.27	55.35 30.35	42.3 62.0	$1.283 \pm 0.050$ $1.264 \pm 0.015$
F(173)	300	ooze over red-brown layer ooze over some sand	>	>	√ (very) √ (very)	shght	0.10	37 30 78.00	62.20	39.0	1.253
G (175)	50 150	black ooze ooze	√ √ (Cladophora)	>>	√ (very)	moderate sewage oily	0.10	31.20 60.90	65.40 39.10	0.09	1.238 ± 0.006 1.309
(177)	20	silty sand & ooze		/ (wood fibre)	>		0.40	46.50	52.71	45.0	1.400
(178)	0	ooze & sandy gravel	√ (Cladophora)		>	only	2.30	51.90	45.55	30.0	1.577
H (174)	50	black ooze ooze & some sand		>>	√ (very) √ (very)	slight slight	010	41 40 58.00	58.50 41.65	610	1.323 1.318 ± 0.028
1(176)	10	ooze & sand	>		/ (quite)		030	78 60	20 94	32.0	1.574
L (54)	320	błack ooze	>	>	√ (very)	oily	030	21 60	78 00	740	1 143
(87)	400	organic ooze		^	>	slightly only	0.10	31.10	68.58	58.0	1.313
MRV		:	;	;	:	:	0.10	0.10	0.10	:	

NOTES: "√= present

Table 6. Bacterial densities in Lake George Channel and Little Lake George surficial sediments.

S	Station		Bacterial Density	/
Transect (Number)	Metres from Canadian shore	Fecal coliforms	Escherichia coli	Fecal Streptococcus
		number.kg <sup>-1</sup>	number.kg <sup>-1</sup>	number.kg <sup>-1</sup>
B (170)	150	<10000	<10000	<10000
	500	<10000	<10000	<10000
C (34)	150	<10000	<10000	<10000
E (172)	150	<10000	<10000	<10000
(3.7_/	300	~14142	~10000	<100000
F (173)	100	~30000	~20000	<100000
	300	~60000	~20000	<10000
0 (175)	50	10000	10000	100000
G (175)	50	~10000	<10000	<100000
	150	~10000	~10000	<100000
(177)	20	~10000	<10000	<10000
(178)	0	~60000	~60000	<100000
H (174)	50	~30000	<10000	<10000
1 (1)	100	~133887	~14422	<21544
1 (176)	10	~70000	~10000	<10000
L (54)	320	<10000	<10000	<10000
(87)	400	<10000	<10000	<10000
Minimum Repo	rtable Value (MRV)	10000	10000	10000

<sup>&</sup>quot;<" = actual result is less than reported value, based on a count of zero for the filter and the particular dilution used (10- or 100-fold).

dilution used (10- or 100-fold).

"~" = approximate value, based on counts between 1 and 9 and the particular dilution used (10- or 100-fold).

Concentrations of organic matter, nutrients and inorganic contaminants in Lake George Channel and Little Lake George surficial sediments. All concentrations on dry weight basis. Table 7.

П	یو	_eë	OI		<u>.</u>	<u>.</u>	<u>در</u>	<u></u>		ري	<u> </u>			<u></u>	<u>د،</u>		<u></u>	<u></u>					
	Zinc	mg kg	<u>s</u>	71	3	뢰	ଛା	200	16	285	티	89	54	<u></u>	[2]	99	450	위	-	0+	:	120	0
	Nickel	mg.kg	<del>5</del> 6	74	7	13	21	91	93	23	17	72	10	27	21	7.6	133	<b>≊</b> I	-	7.1	:	16	
	Mercury	mg.kg '	<0.01 <w< td=""><td>0 11</td><td>0.33</td><td>0.25</td><td>0.30</td><td>0.32</td><td>60:0</td><td>67.0</td><td>0.12</td><td>60:0</td><td>0.02<t< td=""><td>0.34</td><td>0.24</td><td>90:0</td><td>0.24</td><td>&lt;0.01<w< td=""><td>0.01</td><td>0.03<t< td=""><td>:</td><td>0.2</td><td></td></t<></td></w<></td></t<></td></w<>	0 11	0.33	0.25	0.30	0.32	60:0	67.0	0.12	60:0	0.02 <t< td=""><td>0.34</td><td>0.24</td><td>90:0</td><td>0.24</td><td>&lt;0.01<w< td=""><td>0.01</td><td>0.03<t< td=""><td>:</td><td>0.2</td><td></td></t<></td></w<></td></t<>	0.34	0.24	90:0	0.24	<0.01 <w< td=""><td>0.01</td><td>0.03<t< td=""><td>:</td><td>0.2</td><td></td></t<></td></w<>	0.01	0.03 <t< td=""><td>:</td><td>0.2</td><td></td></t<>	:	0.2	
	Magnesium	mg kg	4700	1400	1900	3887	2600	3000	1700	3550	2500	1800	3100	4200	2699	1600	4700	3800	1	1800	ı	;	
	Manganese Magnesium	mg.kg¹	휭	120	230	319	<u>\$2\$</u>	320	250	8	8	110	200	20	391	150	830	280	:	64	ţ	160	1
Metals	Lead	mg.kg ¹	31	21	23	위	21	%I	21	ᇒ	اي	20	15	झ	શ	18	3	98	-	21	;	31	
Inorganics and Heavy Metals	Iron	mg.kg '	45000	12000	24000	23513	46497	32000	23000	58498	45000	8900	12000	61000	41648	13000	58000	<u>21000</u>	20	7400	:	20000	
Inorganic	Cyanide (free)	mg kg¹	0.010 <w< td=""><td>0.010<w< td=""><td>0 010<w< td=""><td>0 010<w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>0 010<w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>W&gt;010 0</td><td>0.010<w< td=""><td>0.019<t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	0.010 <w< td=""><td>0 010<w< td=""><td>0 010<w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>0 010<w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>W&gt;010 0</td><td>0.010<w< td=""><td>0.019<t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	0 010 <w< td=""><td>0 010<w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>0 010<w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>W&gt;010 0</td><td>0.010<w< td=""><td>0.019<t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	0 010 <w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>0 010<w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>W&gt;010 0</td><td>0.010<w< td=""><td>0.019<t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	0.010 <w< td=""><td>0.010<w< td=""><td>0 010<w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>W&gt;010 0</td><td>0.010<w< td=""><td>0.019<t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	0.010 <w< td=""><td>0 010<w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>W&gt;010 0</td><td>0.010<w< td=""><td>0.019<t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<>	0 010 <w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>W&gt;010 0</td><td>0.010<w< td=""><td>0.019<t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<></td></w<></td></w<></td></w<></td></w<>	0.010 <w< td=""><td>0.010<w< td=""><td>W&gt;010 0</td><td>0.010<w< td=""><td>0.019<t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<></td></w<></td></w<></td></w<>	0.010 <w< td=""><td>W&gt;010 0</td><td>0.010<w< td=""><td>0.019<t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<></td></w<></td></w<>	W>010 0	0.010 <w< td=""><td>0.019<t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<></td></w<>	0.019 <t< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<></td></t<>	0.019 <t< td=""><td>0.010<w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<></td></t<>	0.010 <w< td=""><td>T&gt;6100</td><td>0 010 cW</td><td>0.010</td><td>0.010<w< td=""><td>0.1</td><td>:</td><td></td></w<></td></w<>	T>6100	0 010 cW	0.010	0.010 <w< td=""><td>0.1</td><td>:</td><td></td></w<>	0.1	:	
	Cyanide (avail)	mg.kg <sup>1</sup>	0.63	1.7	0.41	0.739	1.018	0.85	0.13	1.99	8.0	0 082	0 022 <t< td=""><td>3.2</td><td><u>:</u>]</td><td>0.062</td><td>2.800</td><td>0.47</td><td>0.010</td><td>0 022<t< td=""><td>0.1</td><td>;</td><td></td></t<></td></t<>	3.2	<u>:</u> ]	0.062	2.800	0.47	0.010	0 022 <t< td=""><td>0.1</td><td>;</td><td></td></t<>	0.1	;	
	Copper	mg.kg '	21	33	37	77	કા	21	ଥା	ଞା	취	7	6]	87	외	<u>의</u>	<u>80</u>	36	-	긺	;	91	
	Chrnmium	mg kg '	ઇ	61	2	<b>%</b>	ଞା	쬐	<u>5</u>	<u>%</u> ا	191	24	24	<b>%</b>	<u>32</u>	22	<u>7.</u>	38	2	77	:	26	
	Cadmium Chrnmlum	mg-kg '	0.99	0 23 <t< td=""><td>0.51</td><td>0.52</td><td>0.82</td><td>0.95</td><td>0.34</td><td>1.15</td><td>0.74</td><td>0.36</td><td>0.24<t< td=""><td>1.20</td><td>0.72</td><td>0 31</td><td>08.1</td><td>0.62</td><td>0 05</td><td>0.87</td><td>:</td><td>9.0</td><td></td></t<></td></t<>	0.51	0.52	0.82	0.95	0.34	1.15	0.74	0.36	0.24 <t< td=""><td>1.20</td><td>0.72</td><td>0 31</td><td>08.1</td><td>0.62</td><td>0 05</td><td>0.87</td><td>:</td><td>9.0</td><td></td></t<>	1.20	0.72	0 31	08.1	0.62	0 05	0.87	:	9.0	
	Arsenie	mg kg ¹	41 00	91	2.6	8.42	=1	8.10	6.50		8.80	2.30	1 60	=1	<del>2</del> 05	2 40	ଆ	6.20	0.20	3.2	:	9	
nts	TKN	g.kg	0.53	9	00.1	2.10	2.75	9	0.80	2.45	9:1	66.0	0.84	2.10	8	0.53	4.9	1.80	0.10	0.30	;	0.55	
Nutrients	1.1	gkg	0.22	0.59	0.50	0 62	96.0	8	0.37	0.79	9	0.31	0 40	0.82	0.51	0.25	<0.01 <w< td=""><td>0.49</td><td>0.02</td><td>0.27</td><td>;</td><td>9.0</td><td></td></w<>	0.49	0.02	0.27	;	9.0	
Matter	TOC	g.kg¹	20	17	의	71	7.8	<u>\$</u>	위	ઢા	<b>©</b> I	<u>تا</u>	킈	7.5	81	2	5.8	찌	0.2	ક્રા	;	10	
Organic Matter	101	gkg	21	110	28	23	001	72	42	8	ঙ্গা	37	61	011	62	24	92	85	s.	5	09	;	
u.	Metres from CDN	shore	150	200	150	150	300	001	300	50	150	20	0	50	100	10	320	00+	_	• pur	DGI	LEL	
Station	Transect Number) fi		B (170)	=	C (34)	E (172)	:	F(173)	:	G (175)	:	(177)	(178)	H (174)	τ	1 (176)	L (54)	(87)	MRV	Background *	OWDMDG	PSQG-LEL	

"--" = not available. NOTES:

<sup>&</sup>quot;<T" = a measurable trace amount, interpret with caution.</p>

<sup>&</sup>quot;<W" = no measurable response (zero); less than reported value
"\*" = upstream hackground concentration in Point aux Pins Bay (Kauss, 1999; OMOE 1986-87).
"OWDMIDG" = concentration below which disposal of dredged material in open water is permitted (Persaud & Wilkins, 1976)

<sup>&</sup>quot;PSQG-LE1." = Lowest Effect Level of contamination that can be tolerated by the majority of heithic organisms (Persaud et al., 1993).
"PSQG-SEL." = Severe Effect Level" of contamination at which pronounced disturbance of the benthic community can be expected. TOC-normalized (Persaud et al., 1993) Underlined values in shaded cells exceed the PSQG-LEL or OWDMDG; holded values exceed the PSQG-SEL.

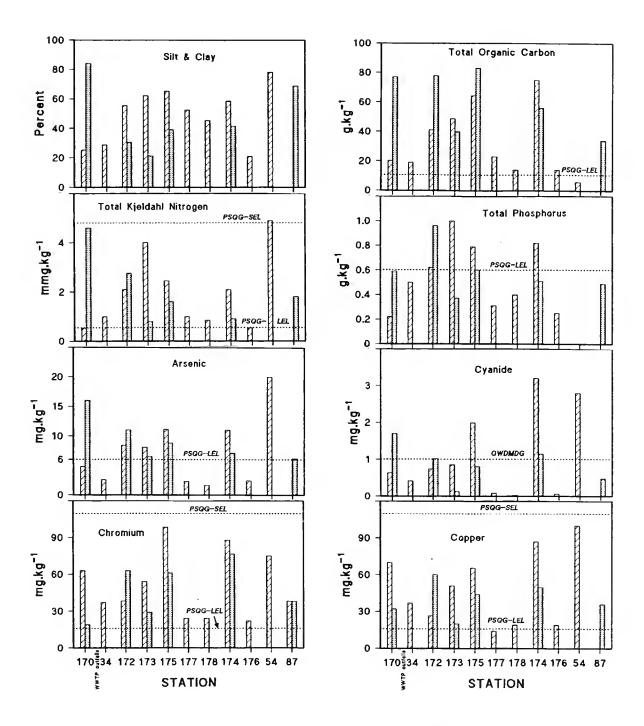


Figure 13. Silt and clay content and concentrations of total organic carbon, total Kjeldahl nitrogen, total phosphorus, arsenic, cyanide, chromium and copper in Lake George Channel and Little Lake George surficial sediments. Bars with diagonal lines represent stations closest to shore; shaded bars represent offshore stations.

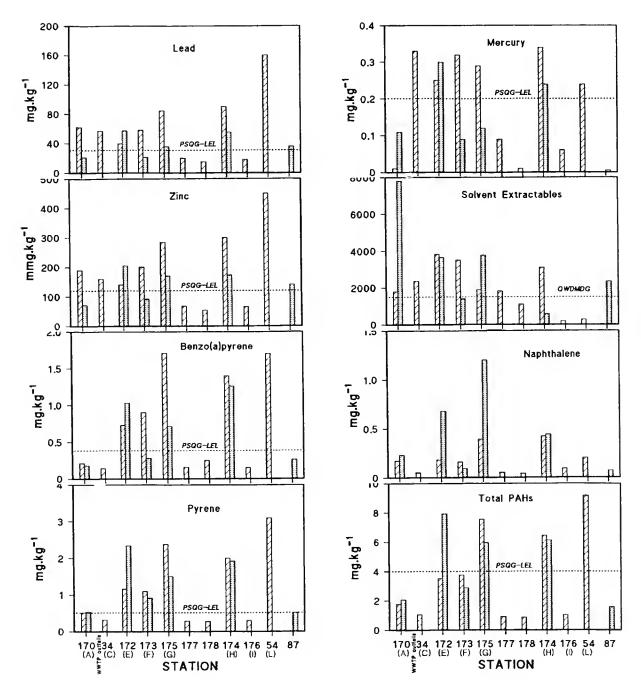


Figure 14. Concentrations of lead, mercury, zinc, solvent extractables, benzo(a)pyrene, naphthalene, pyrene and Total PAHs in Lake George Channel and Little Lake George surficial sediments. Bars with diagonal lines represent stations closest to shore; shaded bars represent offshore stations.

Concentrations of solvent extractables and polycyclic aromatic hydrocarbons in Lake George Channel and Little Lake George surficial sediments. All concentrations in mg.kg<sup>-1</sup>, dry weight basis. Table 8.

Station	uo								Polycy	Polycyclic Aromatic Hydrocarhons	c Hydrocarh	Suc							
Transect (Number)	Metres from CDN shore	Solvent Extractables	Acenaph- thene	Acenaph- thylene	Anthra- cene	Benzo(a)- authracene	Benzo(b)- fluoranthene	Benzo(k)- fluoranthene	Benzo(g.h.1)- Benzo(a)- perylene pyrene	Benzu(a)- pyrene	Chrysene	Dibenzo- (a,h)anthra- cene	Fluoran- thene	Fluorene	Indeno- (1.2,3- cd)pyrene	Naphtha- lene	Phenan- threne	Pyrene	Total of 16 PAHs
B (170)	150	1794	0 04 <t< td=""><td>0.05<t< td=""><td>80.0</td><td>0.24</td><td>0.28</td><td>11 0</td><td>0.11</td><td>0.21</td><td>0.31</td><td>0.04<t< td=""><td>0 63</td><td>0.04<t< td=""><td>0.12</td><td>0 17</td><td>0.32</td><td>0.52</td><td>1.76</td></t<></td></t<></td></t<></td></t<>	0.05 <t< td=""><td>80.0</td><td>0.24</td><td>0.28</td><td>11 0</td><td>0.11</td><td>0.21</td><td>0.31</td><td>0.04<t< td=""><td>0 63</td><td>0.04<t< td=""><td>0.12</td><td>0 17</td><td>0.32</td><td>0.52</td><td>1.76</td></t<></td></t<></td></t<>	80.0	0.24	0.28	11 0	0.11	0.21	0.31	0.04 <t< td=""><td>0 63</td><td>0.04<t< td=""><td>0.12</td><td>0 17</td><td>0.32</td><td>0.52</td><td>1.76</td></t<></td></t<>	0 63	0.04 <t< td=""><td>0.12</td><td>0 17</td><td>0.32</td><td>0.52</td><td>1.76</td></t<>	0.12	0 17	0.32	0.52	1.76
:	200	7807	90 0	0.05 <t< td=""><td>0.09</td><td>0 22</td><td>0.25</td><td>0.12</td><td>0 12</td><td>0.18</td><td>0.30</td><td>0.04<t< td=""><td>0.73</td><td>80.0</td><td>0.13</td><td>0.23</td><td>0.46</td><td>0.53</td><td>2.08</td></t<></td></t<>	0.09	0 22	0.25	0.12	0 12	0.18	0.30	0.04 <t< td=""><td>0.73</td><td>80.0</td><td>0.13</td><td>0.23</td><td>0.46</td><td>0.53</td><td>2.08</td></t<>	0.73	80.0	0.13	0.23	0.46	0.53	2.08
C (34)	150	2360	0.04 <t< td=""><td>0.05<t< td=""><td>900</td><td>0.16</td><td>0 17</td><td>0.10</td><td>0.07</td><td>0.14</td><td>0.21</td><td>0.04<t< td=""><td>61 0</td><td>0.04<t< td=""><td>800</td><td>0.05</td><td>0.22</td><td>0.32</td><td>1.06</td></t<></td></t<></td></t<></td></t<>	0.05 <t< td=""><td>900</td><td>0.16</td><td>0 17</td><td>0.10</td><td>0.07</td><td>0.14</td><td>0.21</td><td>0.04<t< td=""><td>61 0</td><td>0.04<t< td=""><td>800</td><td>0.05</td><td>0.22</td><td>0.32</td><td>1.06</td></t<></td></t<></td></t<>	900	0.16	0 17	0.10	0.07	0.14	0.21	0.04 <t< td=""><td>61 0</td><td>0.04<t< td=""><td>800</td><td>0.05</td><td>0.22</td><td>0.32</td><td>1.06</td></t<></td></t<>	61 0	0.04 <t< td=""><td>800</td><td>0.05</td><td>0.22</td><td>0.32</td><td>1.06</td></t<>	800	0.05	0.22	0.32	1.06
E (172)	150	3814	0.04 <t< th=""><th>0.08</th><th>0.12</th><th>0.59</th><th>1.22</th><th>039</th><th>0.33</th><th>0.73</th><th>96.0</th><th>0.10</th><th>1.33</th><th>90.0</th><th>0.37</th><th>0 18</th><th>0.47</th><th>9]</th><th>3.51</th></t<>	0.08	0.12	0.59	1.22	039	0.33	0.73	96.0	0.10	1.33	90.0	0.37	0 18	0.47	9]	3.51
:	300	3636	0.11	0.12	0.39		1 86	0.78	0.66	1.03	1.59	0.23	2.78	0.14	0.85	89.0	<u>1.30</u>	2.34	7.95
F(173)	901	3506	0.04 <t< th=""><th>800</th><th>0 14</th><th>69.0</th><th>1.20</th><th>0.62</th><th>0.62</th><th>8</th><th>8</th><th>0.21</th><th>130</th><th>90 0</th><th>0.70</th><th>91.0</th><th>6+'0</th><th>1.10</th><th>3.75</th></t<>	800	0 14	69.0	1.20	0.62	0.62	8	8	0.21	130	90 0	0.70	91.0	6+'0	1.10	3.75
*	300	1387	0.05 <t< td=""><td>0.05<t< td=""><td>0.18</td><td>0.42</td><td>0.38</td><td>910</td><td>0 11</td><td>0 28</td><td>0.51</td><td>0.04<t< td=""><td>1.20</td><td>0.07</td><td>0.12</td><td>60 0</td><td>0.54</td><td>16.0</td><td>2.86</td></t<></td></t<></td></t<>	0.05 <t< td=""><td>0.18</td><td>0.42</td><td>0.38</td><td>910</td><td>0 11</td><td>0 28</td><td>0.51</td><td>0.04<t< td=""><td>1.20</td><td>0.07</td><td>0.12</td><td>60 0</td><td>0.54</td><td>16.0</td><td>2.86</td></t<></td></t<>	0.18	0.42	0.38	910	0 11	0 28	0.51	0.04 <t< td=""><td>1.20</td><td>0.07</td><td>0.12</td><td>60 0</td><td>0.54</td><td>16.0</td><td>2.86</td></t<>	1.20	0.07	0.12	60 0	0.54	16.0	2.86
G(175)	20	1880	0.05 <t< th=""><th>0.18</th><th>0.32</th><th>1.28</th><th>2.20</th><th>1.02</th><th>0.95</th><th>171</th><th>88.</th><th>0.35</th><th>2.68</th><th>0.10</th><th>2]</th><th>0.39</th><th>0.95</th><th>2.38</th><th>7.55</th></t<>	0.18	0.32	1.28	2.20	1.02	0.95	171	88.	0.35	2.68	0.10	2]	0.39	0.95	2.38	7.55
5	150	3764	0.10	0 11	0.33	0.66	0.91	0.39	0.44	0.71	0.89	司	08.1	0.13	0.46	1.20	00.	1.50	5.96
(177)	20	1807	0.04 <t< td=""><td>0.05<t< td=""><td>0.02</td><td>0.15</td><td>0.30</td><td>0.13</td><td>0.11</td><td>0.16</td><td>0.26</td><td>0 04<t< td=""><td>0.33</td><td>0 04<t< td=""><td>0.13</td><td>0.05</td><td>0.12</td><td>0.28</td><td>0 91</td></t<></td></t<></td></t<></td></t<>	0.05 <t< td=""><td>0.02</td><td>0.15</td><td>0.30</td><td>0.13</td><td>0.11</td><td>0.16</td><td>0.26</td><td>0 04<t< td=""><td>0.33</td><td>0 04<t< td=""><td>0.13</td><td>0.05</td><td>0.12</td><td>0.28</td><td>0 91</td></t<></td></t<></td></t<>	0.02	0.15	0.30	0.13	0.11	0.16	0.26	0 04 <t< td=""><td>0.33</td><td>0 04<t< td=""><td>0.13</td><td>0.05</td><td>0.12</td><td>0.28</td><td>0 91</td></t<></td></t<>	0.33	0 04 <t< td=""><td>0.13</td><td>0.05</td><td>0.12</td><td>0.28</td><td>0 91</td></t<>	0.13	0.05	0.12	0.28	0 91
(178)	0	1105	0.04 <t< td=""><td>0.05<t< td=""><td>0.03</td><td>91'0</td><td>0.33</td><td>610</td><td>0.16</td><td>0.25</td><td>0.28</td><td>0 0</td><td>0.31</td><td>0.04<t< td=""><td>81.0</td><td>0 04<t< td=""><td>0.10</td><td>0 27</td><td>98.0</td></t<></td></t<></td></t<></td></t<>	0.05 <t< td=""><td>0.03</td><td>91'0</td><td>0.33</td><td>610</td><td>0.16</td><td>0.25</td><td>0.28</td><td>0 0</td><td>0.31</td><td>0.04<t< td=""><td>81.0</td><td>0 04<t< td=""><td>0.10</td><td>0 27</td><td>98.0</td></t<></td></t<></td></t<>	0.03	91'0	0.33	610	0.16	0.25	0.28	0 0	0.31	0.04 <t< td=""><td>81.0</td><td>0 04<t< td=""><td>0.10</td><td>0 27</td><td>98.0</td></t<></td></t<>	81.0	0 04 <t< td=""><td>0.10</td><td>0 27</td><td>98.0</td></t<>	0.10	0 27	98.0
H (174)	20	3110	0.07	0.15	0.31	91.1	1.70	0.83	0.79	9	097	0.25	2.20	0 12	0.82	0.42	8	200	6.44
:	100	878	0 05 <t< td=""><td>0.15</td><td>0.32</td><td>= </td><td>1.77</td><td>89.0</td><td>090</td><td>1.26</td><td>4</td><td>0.23</td><td>2.22</td><td>0.11</td><td>99.0</td><td>0,44</td><td>0.89</td><td>1.92</td><td>6.13</td></t<>	0.15	0.32	=	1.77	89.0	090	1.26	4	0.23	2.22	0.11	99.0	0,44	0.89	1.92	6.13
1 (176)	0.1	161	0.04 <t< td=""><td>0.05<t< td=""><td>0.05</td><td>0 15</td><td>0.18</td><td>0.11</td><td>60.0</td><td>0.15</td><td>0.21</td><td>0.04<t< td=""><td>0.37</td><td>0.04<t< td=""><td>0.10</td><td>0.09</td><td>0.17</td><td>0 30</td><td>1.03</td></t<></td></t<></td></t<></td></t<>	0.05 <t< td=""><td>0.05</td><td>0 15</td><td>0.18</td><td>0.11</td><td>60.0</td><td>0.15</td><td>0.21</td><td>0.04<t< td=""><td>0.37</td><td>0.04<t< td=""><td>0.10</td><td>0.09</td><td>0.17</td><td>0 30</td><td>1.03</td></t<></td></t<></td></t<>	0.05	0 15	0.18	0.11	60.0	0.15	0.21	0.04 <t< td=""><td>0.37</td><td>0.04<t< td=""><td>0.10</td><td>0.09</td><td>0.17</td><td>0 30</td><td>1.03</td></t<></td></t<>	0.37	0.04 <t< td=""><td>0.10</td><td>0.09</td><td>0.17</td><td>0 30</td><td>1.03</td></t<>	0.10	0.09	0.17	0 30	1.03
L.(54)	320	280	0.10	0.15	930	1.50	2.30	8	0.89	1.70	2.00	0.30	36	0.11	96:0	0.20	1.30	3.10	91.6
(87)	400	2340	0 04 <t< td=""><td>0.05<t< td=""><td>90.0</td><td>0.30</td><td>0.38</td><td>0.26</td><td>0.12</td><td>0.26</td><td>0 40</td><td>0.04<t< td=""><td>0.61</td><td>0.04<t< td=""><td>0.13</td><td>0.07</td><td>0.23</td><td>0.52</td><td>1.56</td></t<></td></t<></td></t<></td></t<>	0.05 <t< td=""><td>90.0</td><td>0.30</td><td>0.38</td><td>0.26</td><td>0.12</td><td>0.26</td><td>0 40</td><td>0.04<t< td=""><td>0.61</td><td>0.04<t< td=""><td>0.13</td><td>0.07</td><td>0.23</td><td>0.52</td><td>1.56</td></t<></td></t<></td></t<>	90.0	0.30	0.38	0.26	0.12	0.26	0 40	0.04 <t< td=""><td>0.61</td><td>0.04<t< td=""><td>0.13</td><td>0.07</td><td>0.23</td><td>0.52</td><td>1.56</td></t<></td></t<>	0.61	0.04 <t< td=""><td>0.13</td><td>0.07</td><td>0.23</td><td>0.52</td><td>1.56</td></t<>	0.13	0.07	0.23	0.52	1.56
MRV	^	5.0	t0 0	0.04	0.05	10:0	0.02	90.0	0.02	0.04	0.04	0.02	0.04	0.02	0.04	0.04	0.04	0 07	:
Background *	* pun	1106	0.04 <t< td=""><td>0.04<t< td=""><td>0.01<t< td=""><td>0.02<t< td=""><td>0.06<t< td=""><td>0.02<t< td=""><td>0 04<t< td=""><td>0.04<t< td=""><td>0.02<t< td=""><td>0.04<t< td=""><td>0.04</td><td>0 04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.01<t< td=""><td>0.02<t< td=""><td>0.06<t< td=""><td>0.02<t< td=""><td>0 04<t< td=""><td>0.04<t< td=""><td>0.02<t< td=""><td>0.04<t< td=""><td>0.04</td><td>0 04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.01 <t< td=""><td>0.02<t< td=""><td>0.06<t< td=""><td>0.02<t< td=""><td>0 04<t< td=""><td>0.04<t< td=""><td>0.02<t< td=""><td>0.04<t< td=""><td>0.04</td><td>0 04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.02 <t< td=""><td>0.06<t< td=""><td>0.02<t< td=""><td>0 04<t< td=""><td>0.04<t< td=""><td>0.02<t< td=""><td>0.04<t< td=""><td>0.04</td><td>0 04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.06 <t< td=""><td>0.02<t< td=""><td>0 04<t< td=""><td>0.04<t< td=""><td>0.02<t< td=""><td>0.04<t< td=""><td>0.04</td><td>0 04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.02 <t< td=""><td>0 04<t< td=""><td>0.04<t< td=""><td>0.02<t< td=""><td>0.04<t< td=""><td>0.04</td><td>0 04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0 04 <t< td=""><td>0.04<t< td=""><td>0.02<t< td=""><td>0.04<t< td=""><td>0.04</td><td>0 04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.02<t< td=""><td>0.04<t< td=""><td>0.04</td><td>0 04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.02 <t< td=""><td>0.04<t< td=""><td>0.04</td><td>0 04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04</td><td>0 04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.04	0 04 <t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04<t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0 07<t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<></td></t<>	0 07 <t< td=""><td>0 06<t< td=""><td>0.62<t< td=""></t<></td></t<></td></t<>	0 06 <t< td=""><td>0.62<t< td=""></t<></td></t<>	0.62 <t< td=""></t<>
OWDMDG	4DG	1500	;	;	:	:	:	;	;	:	;	;	;	:	*	:	;	;	:
PSQG-LEL	LEI,	:	;	:	0.22	0.32	;	0.24	0.17	0.37	0.34	90 0	0.75	61 0	0.2	;	0.56	61.0	7
PSQG-SEL	SEI.	:	:		370	1480		1340	320	1440	460	130	1020	160	320	:	056	850	10000

<sup>&</sup>quot;..." = not available "<T" = a measurable trace amount; interpret with caution. NOTES:

<sup>&</sup>quot;<W" = no measurable response (zero); less than reported value.

<sup>&</sup>quot;\*" = upstream background concentration in Point aux Pins Bay (Kauss, 1999)

PSQG-LEL = Lowest Effect Level of contamination that can be tolerated by the majority of benthic organisms (Persaud et al., 1993, OWDMDG" = concentration below which disposal of dredged material in open water is permitted (Persaud & Wilkins, 1976)

<sup>&</sup>quot;PSQG-SEL" = Severe Effect Level" of contamination at which pronounced disturbance of the benthic community can be expected; Requires TOC-normalization (Persand et al., 1993.

Underlined values in shaded cells exceed the PSQG-LEL or OWDMDG; holded values exceed the PSQG-SEL.

Disposal of Dredged Material (Persaud & Wilkins, 1976). Levels of iron from seven of the stations also exceeded the Provincial "Severe Effect Level" (SEL) sediment quality guideline of 40,000 mg.kg<sup>-1</sup> (Table 7). The LEL and SEL guidelines are, respectively, concentrations below which the majority (95%) of benthic organisms would be protected and above which pronounced disturbance of the benthic community can be expected (Persaud, *et al.*, 1993).

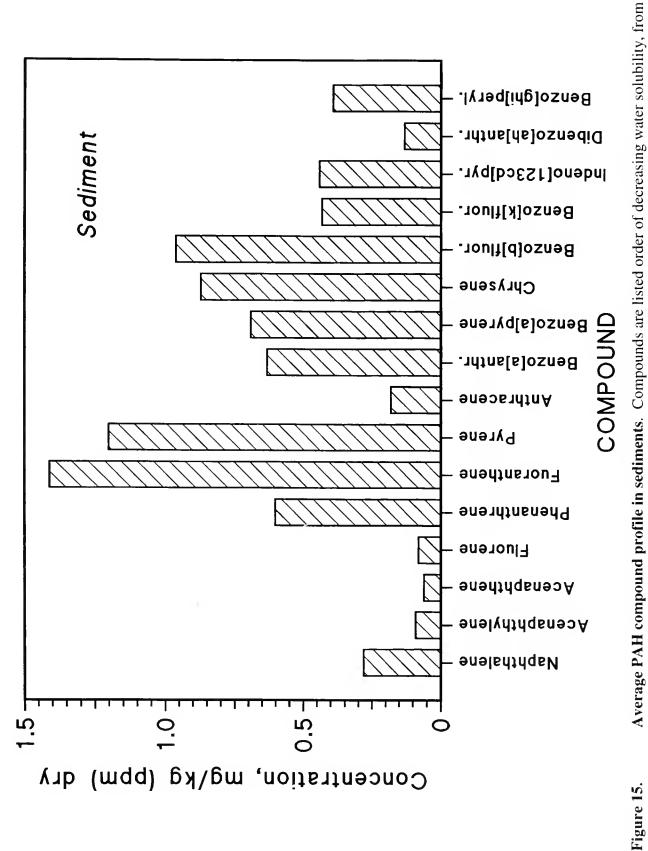
Total phosphorus only exceeded the PSQG-LEL of 0.60 g.kg<sup>-1</sup> at stations on Transects E, F, G and H, all downstream of the WWTP, but total Kjeldahl nitrogen exceed the PSQG-LEL of 0.55 g.kg<sup>-1</sup> on all but one transect, and exceeded the PSQG-SEL of 4.80 g.kg<sup>-1</sup> on transect L (Table 7 and Fig. 13).

Concentrations of solvent extractables exceeded the Provincial Open Water Dredged Material Disposal Guideline of 1,500 mg.kg<sup>-1</sup> at stations on Transects C, E, F, G and H, and at 177 and 87, as well as at the upstream reference stations on Transect B, which had the highest concentration (Table 8). This is contrary to the other contaminants, and suggests a dominating influence from upstream sources (Fig. 14).

All 16 of the unsubstituted PAH compounds analyzed for were detected at all stations; however, concentrations were usually less than 1 mg.kg<sup>-1</sup>. Compounds with the highest concentrations included fluoranthene, phenanthrene and pyrene (Table 8). Presently there are Provincial Sediment Quality Guidelines for 12 individual PAH compounds and for "Total PAHs'. However, sediments from six of the stations, all downstream of the WWTP discharge, contained total PAH levels that exceeded the Provincial LEL of 4 mg.kg<sup>-1</sup> (Fig. 14). Concentrations of many of the individual PAH compounds (as well as of total PAHs) were highest at stations on Transects E, F, G, H and L, located downstream of the WWTP discharge, and 11 of these PAHs exceeded their respective PSQG-LELs (Table 8; Fig. 14).

Of the 16 unsubstituted PAHs analyzed for in the present study, fluoranthene, pyrene, benzo(b)fluoranthene and chrysene were, on average, present at the highest concentrations. This pattern (Fig. 14) is quite similar to that reported for sediments collected upstream, in the Algoma Slag Dump nearshore in 1989 (Kauss, 1999).





### 6.0 CONCLUSIONS AND RECOMMENDATIONS

(i) During the June and August 1989 surveys, the East End WWTP design capacity was exceeded once, during a period of high rainfall on August 22<sup>nd</sup>. WWTP discharge loadings were greatest for all measured parameters (suspended solids, chloride, bacteria (fecal coliforms, *Escherichia coli*, *Pseudomonas aeruginosa*), ammonium, total Kjeldahl Nitrogen, total phosphorus, phenolics, iron and zinc) on August 22<sup>nd</sup>, due to the high discharge rate and elevated levels in the final effluent. On this day, estimated loadings of faecal coliforms were up to 200 times greater, while suspended solids, ammonia, total Kjeldahl nitrogen, total phosphorus, iron and zinc loadings were up to two times greater than on the day with the lowest loading.

The impact of the WWTP discharge on Lake George Channel water quality was evident on fecal coliforms, *E. coli*, *Pseudomonas aeruginosa*, conductivity, chloride, ammonia, total Kjeldahl nitrogen, total phosphorus, phenolics, iron and zinc, levels of which increased noticeably downstream of the discharge point during both surveys. The greatest effect on bacteria densities in river water was found on August 22<sup>nd</sup> and 23<sup>rd</sup>, during and immediately following the period of heavy rainfall. For example, fecal coliform densities exceeded the PWQO for the protection of recreational users as far as 4.7 km downstream (i.e., at Bell Point). (*E. coli* accounted for 42% to 85% of the fecal coliforms in the final effluent.) Total phosphorus exceeded the PWQO to prevent excessive aquatic plant growth in rivers for a distance of up to 0.9 km downstream of the discharge point. Phenolics concentrations exceed the PWQO to prevent tainting of fish flesh at upstream as well as downstream locations, indicating the influence of sources located upriver of the WWTP.

<u>Recommendation</u>: Increases in the efficiency of bacterial treatment and contaminants removal should be pursued. Also, the influence of high rainfall events on WWTP discharge quality and loadings should be minimized, either through plant capacity expansion, or temporary containment of storm water runoff until proper treatment can be effected.

(ii) The discharge area for the WWTP is on a shallow shelf of less than 2 m depth, where currents are quite variable - but typically less than 10 cm.sec<sup>-1</sup>, with variable direction of flow. Because of the shallowness, flow in the discharge area is more susceptible to influence by the wind than the deeper, faster moving waters of the main channel. For example, under northeast wind conditions, the direction of travel of drogues was initially perpendicular to shore, progressing to about 45 degrees relative to the shore for the first 200 m of travel. This can cause the WWTP discharge plume to impinge on U.S. waters (i.e., result in transboundary pollution).

<u>Recommendation</u>: In conjunction with Recommendation (i), if possible, the discharge point should be moved into deeper, faster moving water to improve the dispersion characteristics and mitigate adverse impacts on nearby waters and surficial sediments.

In combination, Recommendations (i) and (ii) would also avoid undesirable impacts within the river further downstream, including transboundary pollution.

(iii) Surficial sediments in Lake George Channel and in Little Lake George were generally very organic in nature (i.e., "oozy"), often with a sewage or oily odour. All samples had an oily sheen. Sediments from up to 2 km downstream of the WWTP discharge contained elevated densities of fecal coliform, Escherichia coli and fecal Streptococcus bacteria. Densities of these organisms reached as high as about 134,000, 14,400 and 21,000 organisms per kg of wet sediment. Concentrations of nutrients and persistent inorganic contaminants (e.g., heavy metals) usually increased downstream of the WWTP discharge, and concentrations were often higher at inshore stations than at offshore stations. Correlation analysis indicated that concentrations of arsenic, cyanide, heavy metals and many of the individual PAH compounds correlated significantly with one another, suggesting a common source. Concentrations of many of the contaminants in Lake George Channel and Little Lake George sediments, as well as at the upstream reference, exceeded the Lowest Effect Level Provincial Sediment Quality Guidelines for the protection of benthic organisms. This indicates that upstream sources contribute or have contributed to sediment quality problems in the Lake George Channel and in Little Lake George. These contaminants include arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc, total PAHs and of 11 individual PAHs. In addition, concentrations of available cyanide at some stations exceeded the Provincial guideline for Open Water Dredged Material Disposal. Iron also exceeded the Provincial "Severe Effect Level" (SEL) sediment quality guideline at some stations. Total phosphorus only exceeded the PSQG-LEL at some stations downstream of the WWTP, but total Kjeldahl nitrogen exceed the PSQG-LEL on all but one transect.

Concentrations of solvent extractables exceeded the Provincial Open Water Dredged Material Disposal Guideline at stations on downstream transects, as well as at the upstream reference stations, which had the highest concentration. This suggests a dominating influence from upstream sources.

Recommendation: The WWTP discharge was identified as contributing, on average, 31.7 and 1.2 kg.day¹ of iron and zinc, respectively. Further monitoring should be conducted on the WWTP final effluent to determine the concentrations and loadings of the persistent contaminants exceeding guidelines in Lake George Channel sediments. Also, the relative contribution of upstream sources and their loadings to sediment contamination in Lake George Channel and Little Lake George should be investigated. This includes point and non-point sources.

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# **APPENDIX**

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Table A-1. 1989 effluent, water and sediment quality sampling station locations.

	<del></del>			Station Descrip	tion	
	Distance (m.)	trom				
Transect (Nomber)	WWTP outtails, upstream (\d/s) or downstream (\d/s)	Canadian shore	Water Depth, m	Lamode	Longitude	Remarks
1	0	-150	0.1	46°30'16"	84°15′22"	Sault Ste Marie, ON East End WWTP final contact chamber
B (170)	100 u/s 	150 500	1 2 3	46°30'13"	84°15'26"	control u/s of Cass Point, on SMD 4 87E (ON) control u/s of Cass Point, on SMD 4 87E (MI)
C (34)	100 d/s 	150 200	1	46°30'20"	84°15′23″	immediately d/s of WWTP discharge, on SMD 5 0E
D (171)	360 d/s	140	1			on SMD 5 17E
**	**	150	12			**
**	**	160	1.5			
**	**	180	1.5			•
**	94	225	2			
**		300	4	46°30'27"	84°15'15"	**
E (172)	500 d/s	150	1			on SMD 5 26E
	**	160	1			
**	**	180	1.5			**
**	**	200	1.5			••
**	a.b.	220	1.5			49
**	à m	240	1.5			*
**	**	250	1.5			
**	ha .	300	3			
**		350	5			
**	**	400	10	46°30'31"	84°15′12"	on SMD 5 26E;; at Brassar Point
F (173)	900 d/s	100	1			on SMD 5.5E
		150	1 1			
**	**	175	1.5			••
		200	2.1			MA.
**	**	225	2 5			"
**	**	250	3 2			··
**	**	300	5.7			
**	4.6	350	10			
	**	5(X) *	10 6	46°30'44"	84°15′03″	on SMD 5 5E, in Masta Bay
G (175)	1200 d/s	50	4.5	46°30'50"	84°1456"	off storm sewer; opposite Point Lewis
**		150	- 6.5			
177	1300 d/s	20	- 1 5	46°30'54"	84°14 52"	ott 51 River Road
178	1330 <b>U</b> s	. 0	- 1 5	46°30'55"	84°14'21"	in private boat slip
H (174)	1700 d/s	50	~ 1.5			on SMD 6.0E; near Air-dale Ltd
		100	4			on SMD 6 0E
	**	200	14			
	**	300	10.3			
**		400 *	4 3	46°31'05"	84°14'41"	on SMD 60E, d/s of Point Lewis
l (176)	2300 d/s	10	~ 1.5	46°30'54"	84°14′53″	off beach at Partridge Point
L (54)	4700 d/s	320 -	6			on SMD 7.9E; off beach at Bell point
	4700 @3	400 *	9.3			on SMD 7 9E
		650 *	10 1	46°32'27"	84°13'12"	on SMD 7 9E, at Palmers Point
	7850 · ·	400			47 # 0 1 × 1 <sup>2</sup> 1 × 11	and take Comme
87	6750 d/s	400	1.8	46°32'57"	84°11'31"	in Little Lake George

<sup>&</sup>quot;=" = water sampled at only 0.2 of total depth
"<" = less than
"-" = approximately
"SMD" = IJC river range; positions are "fixed" at U.S. shore

Summary of project analytical requests and capabilities, historical survey data and water quality objectives Table A-2.

			Ā	Analytical Method *				Observed Values **	alues **	Water (	Water Quality Objectives
Parameter	Reporting Units Method Code	Method Code		Standard Deviation of	Lab. Blank	Lowest	T Value	Background	WWTP Effluent	GLWQA Objective	OMOE PWQ Objective/Guideline
			Lab. Controis	Lab. Duplicates		Reportable Value, W					
Turbidity	FTU	002AII	0.11	0.056 to 0.241	0.057	0.05	0.25		:	-	<10% increase
Suspended Solids	mg.l ¹	206AB5	0 000021	1.07 to 1.87	0.213	0.5	2.5	1.6 <t 3.5<="" td="" to=""><td>29.4 to 53.2</td><td>:</td><td>-</td></t>	29.4 to 53.2	:	-
pH		003AI2	0.041	0.152 to 0 196		0	0	:	7.99 to 8.15	6.5 to 9.0	65 to 8.5
Conductivity @ 25°C	µmhos.cm 1	002B12	2.59	0.79 to 1.86	-	-	5	97.6 to 102.4	536 to 688	TDS not >present level	<1/3 TDS increase over present level
Chloride as Cl	mg.l	004BC2	0.15	0.121 to 0.161	-0.031	0.2	-	1.20 to 1.85	60 to 75	: :	:
Total Phosphorus, as P	mg.l <sup>-1</sup>	504BC2	0.054	0.0129 to 0.0491	0.001	0.020	0.100	0.004 <t 0.020<t<="" td="" to=""><td>2.80 to 5.53</td><td></td><td>0.030</td></t>	2.80 to 5.53		0.030
Ammonia, as N	mg.l <sup>-f</sup>	103DC2	0.008	0 003 to 0.018	0 0019	0.002	0.010	0.046 to 0.066	11.6 to 21.0	0.02 (unionized); 0.5 total	0.02 (unionized)
Total Kjeldahl Nitrogen, as N	mg.l¹	004AC2	0.013	0.0173 to 0.0326	0.018	0.020	0 100	0.046 to 0.200	15.5 to 30.6	4 0	:
Phenolics, 4AAP reactive as Phenol	μg.1	002BC2	0.48	0.148 to 0.848	!	0.2	0.1	0.6 <t 1.8<="" td="" to=""><td>1.8 to 23.6</td><td>-</td><td>1</td></t>	1.8 to 23.6	-	1
Total Iron, as Fe	mg.1	536BA1	0,134	0.037 to 0.056	0.021	0 003	0.010	<0.050 to 0.110	0 81 to 2.20	0.300	0.300
Total Zinc, as Zn	mg.11	535BAI	0.034	0.002	0.004	0 001	0.001	<0.001 to 0.003	0.04 to 0.41	0.030	0.030
Faecal Coliforms	organisms.dl '	TF124	:	2.9 to 9.0	:	10	-	10 to 108	900 to 5.1x10°		100
Escherichia coli	organisms.dl 1	TFC24		2.6 to 19.1		10	:	81068	800 to 4.5x10 <sup>6</sup>		
Pseudomonas aerugmosa	organisms.dl 1	PF48	:	1.9 to 7.6	:	10	1	9 to 13	20 to 4 7x 10 <sup>3</sup>	:	1

NOTES

"\*" from OMOE (1983 & 1991)
"\*\*" from 1986/87 St. Marys River MISA Pilot Ste Study (OMOE, unpubl. data); background = station 440 m upstream of WWTP discharge.
"..." = not available.

Comparison of project analytical requests and capabilities, and historical survey data with sediment quality objectives. Table A-3.

Sediment Quality Objectives	MOE Dredging Guideline	<b>∢</b>	٧×	Y'N	<b>V</b>	09	٧	1.0	2.0	8.0	NA	NA N	1.0	20	25	10,000	20	NA VA	Y V	0.3	٧N	100	1,500	į	<b>∀</b> Z	
	Lake George Channel	230,000-800,000	NA.	23	29-70	23-140	20-92	0.22-1.2	0.804.5	NA NA	NA NA	V V	0.35-2.4	21-110	V.	15,000-81,000	18-130	1,300-5,400	130-780	NA V	7.5-47	50-380	989-2,152	:	3.17 < T-10.4	
Observed Values**	Background	<b>&amp; &amp; &amp; Z Z</b>	Y Y	49	55	89	28	0.27	30	NA	NA	NA NA	0.5	9.6	ΝΑ	5,400	24	026	55	Y'A	4.2	24	1,260		0.01 < T-0.07 < T	
	T Value	A Z	ζ <b>Υ</b>	Ν	Y V	<b>V</b>	NA NA	V.	0.10 to 0.20	٧	٧×	٧X	NA NA	٧X	<b>V</b>	Ϋ́Α	NA V	Y'A	Y'N	٧N	NA V	NA VA	Y V		0.01 to 0.07	
	Lowest Detectable, W	1000	1000	0.1	Y'A	5.0	5.0	0.02	0.10	0.20	0.01	0.01	0.20	2.00	1.00	20.00	1.00	Y'N	2.50	0.01	1.00	1.00	-		0.01 to 0.07	
Analytical Method*	Blank	<b>4</b> 2	Z Z	N A	Ν	Y Z	N A	4.85	٧Z	٧Z	Y Z	<b>∀</b> Z	0.05	1.60	1.26	1.80	1.33	Y Y	0.14	<b>V</b> Z	86.0	7.32	NA		Y V	
Analytic	eviation of: Duplicates	<b>₹</b> 2	C Z	٧×	NA A	0.85 to 9.47	NA AN	0.02 to 0.07	0.05 to 0.38	0.14 to 0.38	N A	Y.	0.07 to 0.17	1.45 to 2.57	1.05 to 3.23	437 to 1,857	1.25 to 14.40	NA A	12.88 to 79.90	0.01 to 0.07	0.51 to 4.55	5.19 to 17.75	NA		٧X	
	Standard Deviation of: Controls Duplicate	<b>V</b> Z	K K	A'N	A'N	3.05	Y Z	0.03	90.0	1.58	¥Z	Y.	0.81	25.5	150	1,262	94.5	NA NA	38.1	0.03	62.6	294	٧ ٧		NA A	
	Method	FCMMF	FSMF	007PZ1	009AB1	001AI2	001AI0	314CC2	314CC2	542AF3	A'N	A'N	535AA0	535 AA0	535AA0	535AA0	535AA0	535AA0	\$35AA0	541AF1	535AA0	535AA0	0M009X		EN100A	
	Reporting Unita	org.100g-1	org.100g	88	88	mg.g.1	mg.g.1	mg.g.	mg.g.1	4g.g.1	48.8-1	42.8.1	ug.g.	MR.R.	ue.e.1	48.8.1	48.8-1	MR. R. 1	ug.g.1	42.g.1	# 5 . s. 1	ure is 1	48.8.1		$\mu g \cdot g^{\cdot 1}$	
	Parameter	Fecal Coliform	E. coli	Particle Size Distribution (<62 mm)	Percent Moisture	Residual Loss on Ignition	Total Organic Carbon	Total Phosphorus	Total Kieldahl Nitrogen	Total Arsenic	Free Cvanide	Available Cvanide	Total Cadmium	Total Chromium	Total Copper	Total Iron	Total Lead	Total Magnesium	Total Manganese	Total Mercury	Total Nickel	Total Zinc	Solvent Extractables	Polycyclic Aromatic Hydrocarbons	(16 compounds)	

From MOE (1983) and Surgis (1987)
 \*\* St. Marys River MISA Pilot Site State (1992), background = Point aux Pins Bay; bacteria data from floating material collected in July 1989.
 NA = Not Available

Table A-4. Meteorological conditions prior to and during July and August, 1989 surveys.

			at	Sault Ste. N	1arie, ON a	irport	on surv	ey vessel
Da	te	Rainfall,	Wind Spe	ed, km.h <sup>-1</sup>	Wind	Direction	W	ind
Month	Day	_mm.	Average	Range	Average	Range	km.h <sup>-1</sup>	Direction
June	20	0.0	.5.7	0 - 15	SSE	E - WSW		
ł	21	0.0	9.7	0 - 22	ESE	E - SE		
	22	0.0	10.6	0 - 22	SE	E - SSW		~~
<b>[</b> "	23	13.4	12.0	7 - 22	Е	E - SSE		
	24	trace	17.8	0 - 30	NW	E - NNW		
	25	0.4	9.4	0 - 22	NW	E - NW		
	26	0.2	6.3	0 - 20	SW	E - W		
	27 *	trace	11.0	0 - 24	NW	N - NNW	9 - 18	SW
**	28 *	0.0	19.6	7 - 35	NW	N - NW	14 - 19	NE
	29 *	0.0	5.6	0 - 17	NW	SE - NW		
"	30 *	0.0	7.3	0 - 19	Е	E - SW		
July	1 *	0.0	6.2	0 - 15	Е	E - WSW		
August	15	1.6	19.3	7 - 28	NW	W - NNW		
٠.	16	0.0	16.9	0 - 28	NW	N - NWW		
٠٠	17	0.0	6.5	0 - 15	W	ENE - NNW		
٠.	18	0.0	7.5	0 - 15	SSE	ENE - S		
44	19	00	9.5	6 - 15	ESE	E-S		
٠٠.	20	0.6	12.0	4 - 28	NW	E - NNW		
٠.	21	trace	17.1	0 - 32	WNW	N - NNW		
٠.	22 *	11.2	9.6	0 - 26	Е	N - NNW	0 - 32	ESE
	23 *	0.0	10.7	0 - 24	WNW	N - NNW	9 - 28	NNE
	24 *	0.0	11.0	0 - 22	ENE	N - NNW	9 - 19	NE NE

NOTES: Airport weather data courtesy of Environment canada, Atmosheric Environment Service. " \* " = survey day.

<sup>&</sup>quot;-" = data not available.

Table A-5. River water sample field blind duplicate (split) data.

		Station:		WWTP effluent	Huent		Stadon 170	1 170	Station 34	n 34				Stadon 171	171			
		Dete:	Jun 28	28	Aug 24	24	Jun 28	28	Aug 24	24	Jun 27	27	Jun 28	82	Aug 22	22	Aug 24	24
		m. from shore:	٥		0		100	0	200	0	160	0	190	_	160		300	_
Parameter	Unde	Semple No.:	26007	25008	83788	63800	63641	83842	88521	89522	83808	63808	63677	83878	88431	68432	88519	88520
																	-	
Conductivity	//B.CITI.1		765.0	788.0	622.0	923.0	9.6	98	180.0	167.0	0.98	0.88	118.0	100.0	0.88	0.88	11.0	11.0
Chloride	mg.f.		66.20	88.40	68.80	81.20	0.20 < W	150	11.70	10.20	1,40	1.40	4.80	4,40	1.80	1.60	3.30	3.10
H	-log of H * J		7.88	7.87	7.46	7.48	7.78	7.67	7.36	7.38	7.83	7.86	7.86	7.83	7.86	7.88	7.78	7.83
Turbidity	5		11.20	11.80	8.60	9.10	1.80	0.43	2.60	2.20	2.10	1.60	1.22	9.80	2.40	3.30	1.36	1.18
Suspended Solids	т. 		21.0	20.7	18.4	21.3	3.2	7.0	4.2	4.2	1.6 <t< td=""><td>2.3<t< td=""><td>2.9</td><td>9.2</td><td>0.4</td><td>3.8</td><td>2.9</td><td>8.2</td></t<></td></t<>	2.3 <t< td=""><td>2.9</td><td>9.2</td><td>0.4</td><td>3.8</td><td>2.9</td><td>8.2</td></t<>	2.9	9.2	0.4	3.8	2.9	8.2
Ammonie	- I.Ou		22.000	21.800	18.400	18.400	0.022	0.020	2.690	2.480	0.038	0.038	0.676	0.684	0.058	0.082	0.544	0.642
Total Kjeldahl Nitrogen	1.00		26.100	26.300	22.600	22.800	0.180	0.200	3.600	3.060	0.200	0.200	0.676	0.860	0.240	0.220	0.740	0.740
Total Phosphorus	mg.l.		0.800	0.820	0.820	0.680	0.008 < T	0.010	0.118	0.100	0.008 <t< th=""><th>0.010</th><th>0.063</th><th>0.027</th><th>0.016</th><th>0.012</th><th>0.026</th><th>0.026</th></t<>	0.010	0.063	0.027	0.016	0.012	0.026	0.026
Phenolics	1.07		66.0	0.08	38.0	38.8	0.8 < W	0.1	8.4	11.2	0.8 <t< td=""><td>0.1</td><td>5.0</td><td>4.1</td><td>3.8</td><td>2.8</td><td>8.8</td><td>11.2</td></t<>	0.1	5.0	4.1	3.8	2.8	8.8	11.2
Iron	mg.l.		0.730	0.880	0.740	0.700	0.180	0.180	0.072 <t< td=""><td>0.074<t< td=""><td>0.100<t< td=""><td>0.0012&lt;</td><td>0.096 &lt; T</td><td>0.0028</td><td>0.180</td><td>0.0018 &lt; 0</td><td>0.081<t 0<="" td=""><td>0.0007 &lt; T</td></t></td></t<></td></t<></td></t<>	0.074 <t< td=""><td>0.100<t< td=""><td>0.0012&lt;</td><td>0.096 &lt; T</td><td>0.0028</td><td>0.180</td><td>0.0018 &lt; 0</td><td>0.081<t 0<="" td=""><td>0.0007 &lt; T</td></t></td></t<></td></t<>	0.100 <t< td=""><td>0.0012&lt;</td><td>0.096 &lt; T</td><td>0.0028</td><td>0.180</td><td>0.0018 &lt; 0</td><td>0.081<t 0<="" td=""><td>0.0007 &lt; T</td></t></td></t<>	0.0012<	0.096 < T	0.0028	0.180	0.0018 < 0	0.081 <t 0<="" td=""><td>0.0007 &lt; T</td></t>	0.0007 < T
												۰				<u>-</u>		
Zinc	T.DE		0.0310	0.0280	0.0240	0.0210	0.0018 <t< th=""><th>0.0017<t< th=""><th>0.0008<t 0.0010<<="" 0.0011<t="" 0.100<t="" th=""><th>0.0011<t< th=""><th>0.100<t< th=""><th>&gt;0100.0</th><th>0.110</th><th>0.0023<t< th=""><th>0.180</th><th>0.0020 &lt; 0.081 &lt; T 0.0008 &lt; T</th><th>.081<t< th=""><th>0008 &lt; T</th></t<></th></t<></th></t<></th></t<></th></t></th></t<></th></t<>	0.0017 <t< th=""><th>0.0008<t 0.0010<<="" 0.0011<t="" 0.100<t="" th=""><th>0.0011<t< th=""><th>0.100<t< th=""><th>&gt;0100.0</th><th>0.110</th><th>0.0023<t< th=""><th>0.180</th><th>0.0020 &lt; 0.081 &lt; T 0.0008 &lt; T</th><th>.081<t< th=""><th>0008 &lt; T</th></t<></th></t<></th></t<></th></t<></th></t></th></t<>	0.0008 <t 0.0010<<="" 0.0011<t="" 0.100<t="" th=""><th>0.0011<t< th=""><th>0.100<t< th=""><th>&gt;0100.0</th><th>0.110</th><th>0.0023<t< th=""><th>0.180</th><th>0.0020 &lt; 0.081 &lt; T 0.0008 &lt; T</th><th>.081<t< th=""><th>0008 &lt; T</th></t<></th></t<></th></t<></th></t<></th></t>	0.0011 <t< th=""><th>0.100<t< th=""><th>&gt;0100.0</th><th>0.110</th><th>0.0023<t< th=""><th>0.180</th><th>0.0020 &lt; 0.081 &lt; T 0.0008 &lt; T</th><th>.081<t< th=""><th>0008 &lt; T</th></t<></th></t<></th></t<></th></t<>	0.100 <t< th=""><th>&gt;0100.0</th><th>0.110</th><th>0.0023<t< th=""><th>0.180</th><th>0.0020 &lt; 0.081 &lt; T 0.0008 &lt; T</th><th>.081<t< th=""><th>0008 &lt; T</th></t<></th></t<></th></t<>	>0100.0	0.110	0.0023 <t< th=""><th>0.180</th><th>0.0020 &lt; 0.081 &lt; T 0.0008 &lt; T</th><th>.081<t< th=""><th>0008 &lt; T</th></t<></th></t<>	0.180	0.0020 < 0.081 < T 0.0008 < T	.081 <t< th=""><th>0008 &lt; T</th></t<>	0008 < T
												۰				<b>-</b>		
Fecal Coliforma	org.dl		5500	9800	2000	2000	23 < W	12	110	120	4	4	104	5 6	1140	1180	40	48
Eschericia coli	org.dl		2700	4600	1400	1700	7 < W	12	80 < W	80 < W	4	4	44	38	720	880	18	36
Peaudomonas anuninosa	ord dl		117 cW	640	220	220	2 <w< td=""><td>4</td><td>4 × W</td><td>20</td><td>2<w< td=""><td>2 × W</td><td>36</td><td>10</td><td>8</td><td>18</td><td>•</td><td>80</td></w<></td></w<>	4	4 × W	20	2 <w< td=""><td>2 × W</td><td>36</td><td>10</td><td>8</td><td>18</td><td>•</td><td>80</td></w<>	2 × W	36	10	8	18	•	80

"CV" = coefficient of variation calculated using CV = [v/2(max.-min.)](max.+min.)]\*100.

\* data from Sturgis (1887).

"<T" = a messurable trace amount; interpret with caution.

"<W" = no messurable response (zero); lessthan reported value.
"... not available or could not be calculated.

Table A-5. continued.

		Station No.:		Station 172	172					Station 173	173			
		Dete:	Jun 29	28	Ą	Aug 24	عر	Jun 27	Jun 29	29	Aug 22	22	Aug	Aug 23
		m. from ehere:	300	0	m	300	_	160	17	176	200	0	2	200
Parametar	Units	Semple No.:	63850	63651	66512	69513	63928	63628	63662	93663	66415	68419	69467	68458
velorinital			0	a	a	0 88	0,401	0 401	103.0	0 00	0 00	98	0	
614.00			200	0.0	0.0	2.0	2.	2	2.0	0.	0.00	0.00	0.00	0.00
Chloride	mg.t.		1.80	1.80	1.60	1.90	2.60	3.20	3.10	3.10	1.60	1.60	1.70	1.70
	-l <b>∞</b> 1,0(H * j		7.67	7.63	7.81	7.86	7.78	7.94	7.70	7.78	7.95	7.87	7.87	7.86
Turbidity	FT		1.65	1.64	1.25	1.42	1.60	1.50	1.24	1.29	1.12	1.06	1.64	1.31
Suspended Solids	mg.l.		3.7	0.3 < W	3.4	3.3	2.8	0.6 < W	6.7	1.8 <t< td=""><td>3.0</td><td>3.1</td><td>1.4<t< td=""><td>1.2<t< td=""></t<></td></t<></td></t<>	3.0	3.1	1.4 <t< td=""><td>1.2<t< td=""></t<></td></t<>	1.2 <t< td=""></t<>
Ammonia	ma.i.		0.032	0.048	0.070	0.070	0.186	0.306	0.242	0.232	0.070	0.072	0.102	0.102
Total Kjeldahl Nitrogen	ma.i.		0.320	0.280	0.200	0.210	0.580	0.580	0.320	0.320	0.210	0.270	0.260	0.240
Total Phospherus	. I.om		0.024	0.024	0.008 < T	0.008 < T	0.029	0.027	0.014	0.016	0.009 < T	0.009 < T	0.009 < T	0.009<
Phenolics	, PG.		1.0	0.1	19.4	2.9	1.9	0.1	1.2	2.0	2.2	9.1	4.1	1.4
Iron	mg.		0.170	0.160	0.170	0.0018 < T	0.110		0.062 <t< td=""><td>0.082<t< td=""><td>0.110</td><td>0.100<t< td=""><td>0.096<t< td=""><td>0.0008</td></t<></td></t<></td></t<></td></t<>	0.082 <t< td=""><td>0.110</td><td>0.100<t< td=""><td>0.096<t< td=""><td>0.0008</td></t<></td></t<></td></t<>	0.110	0.100 <t< td=""><td>0.096<t< td=""><td>0.0008</td></t<></td></t<>	0.096 <t< td=""><td>0.0008</td></t<>	0.0008
Zinc	mg.i.		0.0018 <t< td=""><td>0.0020<t< td=""><td>0.180</td><td>0.0018<t< td=""><td>0.0017 &lt; T</td><td></td><td>0.0021<t< td=""><td>0.0028</td><td>0.0010<t< td=""><td>0.016<t< td=""><td>0.072<t< td=""><td>0.0010</td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.0020 <t< td=""><td>0.180</td><td>0.0018<t< td=""><td>0.0017 &lt; T</td><td></td><td>0.0021<t< td=""><td>0.0028</td><td>0.0010<t< td=""><td>0.016<t< td=""><td>0.072<t< td=""><td>0.0010</td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.180	0.0018 <t< td=""><td>0.0017 &lt; T</td><td></td><td>0.0021<t< td=""><td>0.0028</td><td>0.0010<t< td=""><td>0.016<t< td=""><td>0.072<t< td=""><td>0.0010</td></t<></td></t<></td></t<></td></t<></td></t<>	0.0017 < T		0.0021 <t< td=""><td>0.0028</td><td>0.0010<t< td=""><td>0.016<t< td=""><td>0.072<t< td=""><td>0.0010</td></t<></td></t<></td></t<></td></t<>	0.0028	0.0010 <t< td=""><td>0.016<t< td=""><td>0.072<t< td=""><td>0.0010</td></t<></td></t<></td></t<>	0.016 <t< td=""><td>0.072<t< td=""><td>0.0010</td></t<></td></t<>	0.072 <t< td=""><td>0.0010</td></t<>	0.0010
Fecal Coliforms	org.dl		4 < W	12	40	62	12		90	40	820	099	104	116
Eschericia coli	org.dl		4 < W	4	24	28	4	12	62	40	490	720	72	62
Pseudomonas aeruginosa	org.dl '		2 < W	2 < W	2 <w< td=""><td>10 &lt; W</td><td>4</td><td>2</td><td>2</td><td>2</td><td>39</td><td>29</td><td>01</td><td><b>60</b></td></w<>	10 < W	4	2	2	2	39	29	01	<b>60</b>

"CV" = coefficient of variation calculated using CV = [v/2(max,-min,)]/(max, + min,)]\*100,

\* data from Sturgia (1987),

" <T" = a measurable trace amount; interpret with caution.

" <W" = no measurable response (zero); lessthan reported value.

"-" not available or could not be calculated.

Table A-5. continued.

		Station No.:			Station 174	174				S tat	Station 64		Variability (CV), %	(CV. *	
		Dete:	Jun 27	27	Jun	un 28	Aug 23	23	Aug	Aug 22	Ave	Aug 23			
		m. from shore:	100	0	300	٥	100	o	8	320	9	950			Leboratory
Paremeter	Units	Sample No.:	63618	63620	63867	83868	88448	68450	68402	68403	68446	88447	Field	Laboratory *	Blank .
			,												
Conductivity	/wa.cm		88.0	0.98	86.0	96.0	87.0	87.0	97.0	87.0	0.88	86.0	0.0 to 12.4		
Chloride	mg.l.		1.40	1.40	1.40	1.40	1.40	1.40	1.50	1.40	1.30	1.30	0.0 to 8.28		
Ha	-togio[H*]		7.80	7.86	7.84	7.86	7.88	8.00	7.84	7.68	8.02	8.03	0.0 to 1.44		
Turbidity	FTU		1.10	1.00	0.87	98.0	1.46	2.70	0.70	0.78	0.80	1.88	0.0 to 97.3		
Suspended Solide	1.gm		1.3 <t< td=""><td>0.8<t< td=""><td>1.1<t< td=""><td>1.0<t< td=""><td>3.8</td><td>3.6</td><td>2.4<t< td=""><td>2.2<t< td=""><td>2.2<t< td=""><td>1.8<t< td=""><td>0.0 to 120</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.8 <t< td=""><td>1.1<t< td=""><td>1.0<t< td=""><td>3.8</td><td>3.6</td><td>2.4<t< td=""><td>2.2<t< td=""><td>2.2<t< td=""><td>1.8<t< td=""><td>0.0 to 120</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	1.1 <t< td=""><td>1.0<t< td=""><td>3.8</td><td>3.6</td><td>2.4<t< td=""><td>2.2<t< td=""><td>2.2<t< td=""><td>1.8<t< td=""><td>0.0 to 120</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	1.0 <t< td=""><td>3.8</td><td>3.6</td><td>2.4<t< td=""><td>2.2<t< td=""><td>2.2<t< td=""><td>1.8<t< td=""><td>0.0 to 120</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<>	3.8	3.6	2.4 <t< td=""><td>2.2<t< td=""><td>2.2<t< td=""><td>1.8<t< td=""><td>0.0 to 120</td><td></td><td></td></t<></td></t<></td></t<></td></t<>	2.2 <t< td=""><td>2.2<t< td=""><td>1.8<t< td=""><td>0.0 to 120</td><td></td><td></td></t<></td></t<></td></t<>	2.2 <t< td=""><td>1.8<t< td=""><td>0.0 to 120</td><td></td><td></td></t<></td></t<>	1.8 <t< td=""><td>0.0 to 120</td><td></td><td></td></t<>	0.0 to 120		
Ammonia	. J. 6E		0.040	0.042	0.018	0.008 <t< td=""><td>0.048</td><td>0.048</td><td>0.042</td><td>0.040</td><td>0.028</td><td>0.028</td><td>0.0 to 31.0</td><td></td><td></td></t<>	0.048	0.048	0.042	0.040	0.028	0.028	0.0 to 31.0		
Total Kjeldahl Nitrogen	. I.ge		0.180	0.180	0.140	0.140	0.240	0.180	0.180	0.160	0.150	0.180	0.0 to 27.3		
Total Phosphorus	. F. Ou		0.008 <t< td=""><td>0.00B<t< td=""><td>0.002 &lt; W</td><td>0.002<w< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.004<t< td=""><td>0.005 &lt; T</td><td>0.0 to 46.0</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<></td></w<></td></t<></td></t<>	0.00B <t< td=""><td>0.002 &lt; W</td><td>0.002<w< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.004<t< td=""><td>0.005 &lt; T</td><td>0.0 to 46.0</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<></td></w<></td></t<>	0.002 < W	0.002 <w< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.004<t< td=""><td>0.005 &lt; T</td><td>0.0 to 46.0</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<></td></w<>	0.008 <t< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.004<t< td=""><td>0.005 &lt; T</td><td>0.0 to 46.0</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<>	0.008 <t< td=""><td>0.008<t< td=""><td>0.008<t< td=""><td>0.004<t< td=""><td>0.005 &lt; T</td><td>0.0 to 46.0</td><td></td><td></td></t<></td></t<></td></t<></td></t<>	0.008 <t< td=""><td>0.008<t< td=""><td>0.004<t< td=""><td>0.005 &lt; T</td><td>0.0 to 46.0</td><td></td><td></td></t<></td></t<></td></t<>	0.008 <t< td=""><td>0.004<t< td=""><td>0.005 &lt; T</td><td>0.0 to 46.0</td><td></td><td></td></t<></td></t<>	0.004 <t< td=""><td>0.005 &lt; T</td><td>0.0 to 46.0</td><td></td><td></td></t<>	0.005 < T	0.0 to 46.0		
Phenolics	. J. 64		0.4 <t< td=""><td>0.4<t< td=""><td>0.2<t< td=""><td>0.2<t< td=""><td>2.0</td><td>1.8</td><td>1.8</td><td></td><td>9.1</td><td>0.8<t< td=""><td>0.0 to 105</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<>	0.4 <t< td=""><td>0.2<t< td=""><td>0.2<t< td=""><td>2.0</td><td>1.8</td><td>1.8</td><td></td><td>9.1</td><td>0.8<t< td=""><td>0.0 to 105</td><td></td><td></td></t<></td></t<></td></t<></td></t<>	0.2 <t< td=""><td>0.2<t< td=""><td>2.0</td><td>1.8</td><td>1.8</td><td></td><td>9.1</td><td>0.8<t< td=""><td>0.0 to 105</td><td></td><td></td></t<></td></t<></td></t<>	0.2 <t< td=""><td>2.0</td><td>1.8</td><td>1.8</td><td></td><td>9.1</td><td>0.8<t< td=""><td>0.0 to 105</td><td></td><td></td></t<></td></t<>	2.0	1.8	1.8		9.1	0.8 <t< td=""><td>0.0 to 105</td><td></td><td></td></t<>	0.0 to 105		
tron	. I.OE		0.081 <t< td=""><td>0.085<t< td=""><td>0.037 &lt; T</td><td>0.038<t< td=""><td>0.110</td><td>0.100<t< td=""><td>0.076<t< td=""><td>0.078<t< td=""><td>0.068<t< td=""><td>0.087<t< td=""><td>0.0 to 138</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.085 <t< td=""><td>0.037 &lt; T</td><td>0.038<t< td=""><td>0.110</td><td>0.100<t< td=""><td>0.076<t< td=""><td>0.078<t< td=""><td>0.068<t< td=""><td>0.087<t< td=""><td>0.0 to 138</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.037 < T	0.038 <t< td=""><td>0.110</td><td>0.100<t< td=""><td>0.076<t< td=""><td>0.078<t< td=""><td>0.068<t< td=""><td>0.087<t< td=""><td>0.0 to 138</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.110	0.100 <t< td=""><td>0.076<t< td=""><td>0.078<t< td=""><td>0.068<t< td=""><td>0.087<t< td=""><td>0.0 to 138</td><td></td><td></td></t<></td></t<></td></t<></td></t<></td></t<>	0.076 <t< td=""><td>0.078<t< td=""><td>0.068<t< td=""><td>0.087<t< td=""><td>0.0 to 138</td><td></td><td></td></t<></td></t<></td></t<></td></t<>	0.078 <t< td=""><td>0.068<t< td=""><td>0.087<t< td=""><td>0.0 to 138</td><td></td><td></td></t<></td></t<></td></t<>	0.068 <t< td=""><td>0.087<t< td=""><td>0.0 to 138</td><td></td><td></td></t<></td></t<>	0.087 <t< td=""><td>0.0 to 138</td><td></td><td></td></t<>	0.0 to 138		
Zinc	. I.o.		0.0008 < T	0.0007 < T	0.0007 < T	0.0007 < T	0.0011 <t< td=""><td>0.0011</td><td>0.0007 &lt; T</td><td>0.0008<t< td=""><td>0.0005 &lt; W</td><td>0.0006 &lt; W</td><td>0.0 to 138</td><td></td><td></td></t<></td></t<>	0.0011	0.0007 < T	0.0008 <t< td=""><td>0.0005 &lt; W</td><td>0.0006 &lt; W</td><td>0.0 to 138</td><td></td><td></td></t<>	0.0005 < W	0.0006 < W	0.0 to 138		
Fecal Coliforme	org.dl '		4	7	40	4	72	72	472	612	40	36	0.0 to 118		
Eschericia coli	org.df.1		4	7	28	4	99	48	300	366	24	32	0.0 to 106		
Psaudomonas aaruginosa	org.dl 1		7	2 < W	2	2 < W	4	9	5	14	9	12	0.0 to 84.3		

"CV" = coefficient of variation calculated using CV = [V2{max.-min.}]/(max.+min.]]\*100.

\* data from Sturgia (1887).

"<T" = a measurable trace amount; interpret with caution.

"<W" = no measurable response (zero); leasthan reported value.

"-" not available or could not be calculated.

Table A-6. River water samples field blank data.

		Station No.:			Statio	Station 170			Station 172	
		Date:	Jun 27	Jun 28	Jun 29	Aug 22	Aug 23	Aug 24	Jun 27	
		metres from shore:	150 m	500 m	500 m	500 m	500 m	500 m	240 m	Laboratory Blank
Parameter	Unite	Sample No.:	63601	63646	63684	68439	68485	68526	63638	
						ı			,	
Conductivity	/ws.cm		5.0	5.0	2.0	2.0 <t< td=""><td>1.0&lt;</td><td>2.0<t< td=""><td>2.0</td><td></td></t<></td></t<>	1.0<	2.0 <t< td=""><td>2.0</td><td></td></t<>	2.0	
Chloride	mg.l. <sub>1</sub>		0.20 < W	0.20 < W	0.20 < W	0.20 < W	0.20 < W	0.20 < W	3.20	
Ha	·log <sub>10</sub> (H°)		6.21	6.13	6.23	6.17	5.69	6.07	6.07	
Turbidity	FTU	٠	0.31	0.51	0.43	0.88	0.25	0.55	1.81	
Suspanded Solids	mg.l.		5.3 <w< td=""><td>0.8<t< td=""><td>0.7<t< td=""><td>1.1<t< td=""><td>0.4 &lt; W</td><td>0.5<t< td=""><td>0.5 &lt; W</td><td></td></t<></td></t<></td></t<></td></t<></td></w<>	0.8 <t< td=""><td>0.7<t< td=""><td>1.1<t< td=""><td>0.4 &lt; W</td><td>0.5<t< td=""><td>0.5 &lt; W</td><td></td></t<></td></t<></td></t<></td></t<>	0.7 <t< td=""><td>1.1<t< td=""><td>0.4 &lt; W</td><td>0.5<t< td=""><td>0.5 &lt; W</td><td></td></t<></td></t<></td></t<>	1.1 <t< td=""><td>0.4 &lt; W</td><td>0.5<t< td=""><td>0.5 &lt; W</td><td></td></t<></td></t<>	0.4 < W	0.5 <t< td=""><td>0.5 &lt; W</td><td></td></t<>	0.5 < W	
Ammonia	mg.l 1		0.002 < W	0.002 < W	0.002 < W	0.010	0.002 < W	0.002 < W	0.002 < W	
Total Kjaldahi Nitrogan	mg.1¹		0.070 <t< td=""><td>0.050<t< td=""><td>0.050<t< td=""><td>0.040<t< td=""><td>0.020 &lt; W</td><td>0.030<t< td=""><td>0.050<t< td=""><td></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.050 <t< td=""><td>0.050<t< td=""><td>0.040<t< td=""><td>0.020 &lt; W</td><td>0.030<t< td=""><td>0.050<t< td=""><td></td></t<></td></t<></td></t<></td></t<></td></t<>	0.050 <t< td=""><td>0.040<t< td=""><td>0.020 &lt; W</td><td>0.030<t< td=""><td>0.050<t< td=""><td></td></t<></td></t<></td></t<></td></t<>	0.040 <t< td=""><td>0.020 &lt; W</td><td>0.030<t< td=""><td>0.050<t< td=""><td></td></t<></td></t<></td></t<>	0.020 < W	0.030 <t< td=""><td>0.050<t< td=""><td></td></t<></td></t<>	0.050 <t< td=""><td></td></t<>	
Total Phosphorus	mg.t		0.003 <t< td=""><td>0.008<t< td=""><td>0.008<t 0.002<w<="" td=""><td>0.003<t< td=""><td>0.002<w< td=""><td>0.002 &lt; W</td><td>0.003<t< td=""><td></td></t<></td></w<></td></t<></td></t></td></t<></td></t<>	0.008 <t< td=""><td>0.008<t 0.002<w<="" td=""><td>0.003<t< td=""><td>0.002<w< td=""><td>0.002 &lt; W</td><td>0.003<t< td=""><td></td></t<></td></w<></td></t<></td></t></td></t<>	0.008 <t 0.002<w<="" td=""><td>0.003<t< td=""><td>0.002<w< td=""><td>0.002 &lt; W</td><td>0.003<t< td=""><td></td></t<></td></w<></td></t<></td></t>	0.003 <t< td=""><td>0.002<w< td=""><td>0.002 &lt; W</td><td>0.003<t< td=""><td></td></t<></td></w<></td></t<>	0.002 <w< td=""><td>0.002 &lt; W</td><td>0.003<t< td=""><td></td></t<></td></w<>	0.002 < W	0.003 <t< td=""><td></td></t<>	
Phanolics	1.84		0.2 <t< td=""><td>0.6<t< td=""><td>0.6<t< td=""><td>2.0</td><td>1.4</td><td>5</td><td>1.0</td><td></td></t<></td></t<></td></t<>	0.6 <t< td=""><td>0.6<t< td=""><td>2.0</td><td>1.4</td><td>5</td><td>1.0</td><td></td></t<></td></t<>	0.6 <t< td=""><td>2.0</td><td>1.4</td><td>5</td><td>1.0</td><td></td></t<>	2.0	1.4	5	1.0	
fron	mg.l		0.020 < W	0.020 < W   0.020 < W	0.020 < W	0.027 <t< td=""><td>0.020 &lt; W</td><td>0.020 &lt; W</td><td>0.021 &lt; T</td><td></td></t<>	0.020 < W	0.020 < W	0.021 < T	
Zinc	mg.I <sup>-1</sup>		0.0026	0.0005 < W 0.0010 < T	0.0010 <t< td=""><td>0.0110</td><td>0.0039</td><td>0.0006<t< td=""><td>0.0034</td><td></td></t<></td></t<>	0.0110	0.0039	0.0006 <t< td=""><td>0.0034</td><td></td></t<>	0.0034	
Facal Coliforms	org.dl <sup>-1</sup>			4 < W	4 < W	16	4 < W	4 < W		
Eschericia coli	org.dl <sup>1</sup>			4 < W	4 < W	16	4 < W	4 < W		
Pseudomonas aeruginosa	org.dl <sup>-1</sup>			2 < W	2 < W	01	2 < W	2 <w< td=""><td></td><td></td></w<>		

NOTES:

\* data from Sturgis (1987).

"<T" = s massurable trace amount; interpret with caution.

"<W" = no massurable response (zero); lass than reported value.
"..." not available or could not be calculated.

Table A-7. Sediment sample field blind duplicates (split) data.

		Statio	n 172	Statio	n 175	Variabilit	v (CV), %	Laboratory
Parameter	Units	68233	68234	68237	68238	Field	Laboratory *	Blank *
					-			
2000-1000 μm	%	0.30	0.30	0.10	0.10	0.0		
999-62 μm	%			31.10	31.30	0.5		
<62 μm	%			65.30	65.50	0.2		
Moisture	%	58.0	66.0	66.0	66.0	0.0 to 9.1		
Field Density	g.cm <sup>-3</sup>	1.275	1.253	1.234	1.242	0.5 to 1.2		1
Faecal Coliforms	number.kg 1	~1000	~2000	~1000	<1000	~47.1		
Escherichio coli	number.kg 1	<1000	~1000	<1000	<1000	0.0 to ~47 1		ļ
Faecal Streptococcus	number.kg <sup>-1</sup>	<10000	<10000	<1000	<10000	0.0 to ~116		i
Loss on Ignition	g.kg <sup>-1</sup>	100.0	100.0	87.1	81.0	0.0 to 5.1	6.6	
Total Organic Carbon	g.kg <sup>-1</sup>	78.3	78.0	65.0	64.0	0.3 to 1.1	3.2	
Total Kjeldahl Nitrogen	g.kg <sup>-1</sup>	2.90	2.60	2.40	2.50	2.0 to 7.7	4.9	
Total Phosphorus	g.kg <sup>-1</sup>	1.00	0.92	0.77	0.81	3.6 to 5.9	6.0	
Arsenic	mg.kg <sup>-1</sup>	11.0	11.0	13.00	9.50	0.0 to 22.0	12.1	0.00
Cyanide, avial.	mg.kg <sup>-1</sup>	0.610	1.700	1.800	2.200	14.1 to 66.7	-	0.00
Cyanide, free	mg.kg <sup>-1</sup>	0.010 <w< td=""><td>0.010<w< td=""><td>0.010<w< td=""><td>0 010<w< td=""><td>~0.0</td><td></td><td></td></w<></td></w<></td></w<></td></w<>	0.010 <w< td=""><td>0.010<w< td=""><td>0 010<w< td=""><td>~0.0</td><td></td><td></td></w<></td></w<></td></w<>	0.010 <w< td=""><td>0 010<w< td=""><td>~0.0</td><td></td><td></td></w<></td></w<>	0 010 <w< td=""><td>~0.0</td><td></td><td></td></w<>	~0.0		
Cadmium	mg.kg	0.86	0.010< 11	1.10	1.20	6.1 to 6.9	12.8	0.04
Chromium	mg.kg <sup>-1</sup>	62.0	64.0	97.0	100.0	2.2	10.7	1.60
Copper	mg.kg <sup>-1</sup>	59.0	61.0	67.0	64.0	2.4 to 3.2	9.4	1.26
Iron	mg.kg <sup>-1</sup>	47000	46000	59000	58000	1.2 to 1.5	3.2	1.80
Lead	mg.kg <sup>-1</sup>	57.0	58.0	86.0	83.0	1.2 to 2.5	7.8	1.33
Magnesium	mg.kg <sup>-1</sup>	2600	2600	3600	3500	0.0 to 2.0	7.0	1
Manganese	mg.kg <sup>-1</sup>	530	520	600	600	0.0 to 1.3		
Mercury	mg.kg <sup>-1</sup>	0.32	0.28		0.30		10.6	-
Nickel	mg.kg	22.0	21.0	0.28 23.0	23.0	4.9 to 9 4	10.6 5.1	0.98
Zinc						0.0 to 3.3		1
Solvent Extractables	mg.kg <sup>-1</sup> mg.kg <sup>-1</sup>	200.0 4295	210.0 3078	290.0 2226	280.0 1587	3.4 to 2.5 23.3 to 23.7	9.5	7.32
Acenaphthene	mg.kg	0.10	0.13	0.06	0.05 <t< td=""><td></td><td></td><td></td></t<>			
·						12.9 to 18.4		1
Acenaphthylene Anthracene	mg.kg <sup>-1</sup>	0.13 0.37	0.12 0.41	0.20	0.17	6.1 to 11.5		
Benz(a)anthracene	mg.kg <sup>-1</sup>			0.34	0.30	7.2 to 8.8		l
Benzo(b)fluoranthene	mg.kg <sup>-1</sup>	1.00	1.80	1.50	1.10	21 8 to 40 4		l .
Benzo(k)fluoranthene	mg.kg <sup>-1</sup>	1.50	2.30	2.70	1 80	28.2 to 29.8		1
	mg.kg <sup>-1</sup>	0.720	0.850	1.20	0.86	11.7 to 23.3		1
Benzo(g,h,1)perylene	mg.kg <sup>-1</sup>	0.77	0.57	1.00	0.90	7.4 to 21.1		í
Benzo(a)pyrene	mg.kg <sup>-1</sup>	1.10	0.96	2.10	1.40	9.6 to 28.3		ļ.
Chrysene	mg.kg <sup>-1</sup>	1.40	1 80	2.20	1.60	17.7 to 22.3		1
Dibenzo(a,h)anthracene	mg.kg <sup>1</sup>	0.26	0.21	0.38	0.32	12.1 to 15.0		
Fluoranthene	mg.kg <sup>-1</sup>	2.50	3 10	3.00	2.40	15.2 to 15.7		Ì
Fluorene	mg.kg <sup>-1</sup>	0.14	0.14	0.11	0.10	0.0 to 6.7		
Indeno(1,2,3-cd)pyrene	mg.kg <sup>-1</sup>	0.86	0.84	1.20	1.10	1.7 to 6.1		
Naphthalene	mg.kg l	0.81	0.57	0.42	0.36	10.9 to 24.6		
Phenanthrene	mg.kg	1.30	1.30	1.00	0.91	0.0 to 6.7		
Рутепе	mg.kg <sup>-1</sup>	2.20	2.50	2.70	2.10	9.0 to 17.7		
D <sub>10</sub> -Acenaphthene recovery	%	73	62	53	53			
D <sub>12</sub> -Chrysene recovery	%	93	99	115	96			
D <sub>8</sub> -Naphthalene recovery	%	36	44	20	20			
D <sub>12</sub> -Perylene recovery	%	118	163	140	115			
D <sub>10</sub> -Phenanthrene recovery	% .	90	90	74	72			1
								<u></u>

<sup>&</sup>quot;CV" = coefficient of variation calculated using CV =  $[\sqrt{2(\text{max -min.})/(\text{max.+min.})}]*100$ 

<sup>\*</sup> data from Sturgis (1987).

"<T" = a measurable trace amount; interpret with caution.

<sup>&</sup>quot;<W" = no measurable response (zero); less than reported value.

<sup>&</sup>quot;--" not available or could not be calculated.

Table A-8. Sediment sample field replicates data.

			Station 172			Station 174		Variability (C	V), %	Lab. %
Parameter	Units	68228	68229	68230	68242	68243	68244	Field	Lab. *	Recovery *
2000-1000 μm	%	0.1	0.1	0.1	0.3	0.1	0.1	0,0 to 69.3		
999-62 μm	%	49.6	34.1	49.1	73 8	54.8	45.4	19.9 to 24.9		_
<62 μm	%	48.6	63.6	50.6	25_8	41.2	52.7	15.0 to 33.8		-
Moisture	%	57.0	67 0	59.0	57.0	61.0	610	3.9 to 8.7		
Field Density	g.cm <sup>3</sup>	1.321	1.226	1.302	1 347	1.291	1.317	2.1 to 3.9		
Faecal Coliforms	number.kg <sup>-1</sup>	<1000	<1000	~1000	~8000	10000	~30000	~43.3 to 76.0		
Escherichia coli	number kg <sup>-1</sup>	<1000	<1000	<1000	~1000	-3000	<1000	~0.0 to 88.2		i
Faecal Streptococcus	number.kg 1	<10000	<10000	<1000	<10000	<1000	<1000	~74.2 to 130		
Loss on Ignition	g.kg 1	47.0	81.0	48.0	62.0	76.0	77.0	11.7 to 33.0	7.1	
Total Organic Carbon	g kg <sup>1</sup>	35.0	57.0	35.0	51.0	62.0	56 0	9.8 to 30.0	2.7	l _
Total Kjeldahl Nitrogen	g kg 1	1.90	2.70	1.80	0.82	1.10	0.80	18.5 to 23.1	4.9	
Total Phosphorus	g.kg <sup>-1</sup>	0.57	0.75	0.55	0.50	0.58	0.46	11.9 to 17.7	3.5	_
Arsenic	mg.kg <sup>-1</sup>	6.90	12.00	7.20	5.40	6.80	9 70	30 0 to 32.9	14.3	
Cyanide, avial	mg.kg <sup>-1</sup>	0.780	1_400	0.370	0 930	0.910	1.800	41.9 to 61.0		
Cyanide, free	mg kg <sup>1</sup>	0.010 <w< td=""><td>0.019<t< td=""><td>0.010<w< td=""><td>0 019<t< td=""><td>0 019<t< td=""><td>0.020<t< td=""><td>3.0 to 173</td><td></td><td></td></t<></td></t<></td></t<></td></w<></td></t<></td></w<>	0.019 <t< td=""><td>0.010<w< td=""><td>0 019<t< td=""><td>0 019<t< td=""><td>0.020<t< td=""><td>3.0 to 173</td><td></td><td></td></t<></td></t<></td></t<></td></w<></td></t<>	0.010 <w< td=""><td>0 019<t< td=""><td>0 019<t< td=""><td>0.020<t< td=""><td>3.0 to 173</td><td></td><td></td></t<></td></t<></td></t<></td></w<>	0 019 <t< td=""><td>0 019<t< td=""><td>0.020<t< td=""><td>3.0 to 173</td><td></td><td></td></t<></td></t<></td></t<>	0 019 <t< td=""><td>0.020<t< td=""><td>3.0 to 173</td><td></td><td></td></t<></td></t<>	0.020 <t< td=""><td>3.0 to 173</td><td></td><td></td></t<>	3.0 to 173		
Cadmium	mg kg <sup>-1</sup>	0.88	0.23 <t< td=""><td>0.70</td><td>0 67</td><td>0.67</td><td>0.84</td><td>13.5 to 55.6</td><td>6.5</td><td></td></t<>	0.70	0 67	0.67	0.84	13.5 to 55.6	6.5	
Chromium	mg.kg <sup>-1</sup>	72.0	16.0	49.0	69 0	89.0	73.0	13.7 to 61.6	11.6	
Copper	mg.kg <sup>-1</sup>	51.0	10.0	37.0	42.0	47.0	62.0	20.7 to 63.8	9.7	
Iron	mg.kg <sup>-1</sup>	40000	13000	25000	35000	43000	48000	15.6 to 52.0	47	
Lead	mg.kg 1	90.0	11.0	63.0	52 0	57.0	57.0	5.2 to 73.5	10.1	
Magnesium	mg.kg	3000	8900	2200	2600	2700	2800	3.7 to 85 3		_
Manganese	mg.kg	380	330	260	290	390	530	18 6 to 29 9		_
Mercury	mg.kg	0.24	0.33	0.19	0 22	0.26	0.25	8.6 to 28.0	7.6	
Nickel		28.0	10.0	13.0	140	16.0	20.0		10.0	
Zinc	mg.kg <sup>1</sup> mg.kg <sup>1</sup>	290.0	50.0	190.0	130 0	170.0	230.0	18.3 to 56.7 28.5 to 68.2	9 7	
Solvent Extractables	mg.kg	3608	5131	2998	351	370	1489		9 /	-
		0.04 <t< td=""><td>0.04<t< td=""><td>2998 0.04<t< td=""><td>0.05<t< td=""><td>0.06</td><td>0.05<t< td=""><td>28.1 to 88.5</td><td></td><td>-</td></t<></td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>2998 0.04<t< td=""><td>0.05<t< td=""><td>0.06</td><td>0.05<t< td=""><td>28.1 to 88.5</td><td></td><td>-</td></t<></td></t<></td></t<></td></t<>	2998 0.04 <t< td=""><td>0.05<t< td=""><td>0.06</td><td>0.05<t< td=""><td>28.1 to 88.5</td><td></td><td>-</td></t<></td></t<></td></t<>	0.05 <t< td=""><td>0.06</td><td>0.05<t< td=""><td>28.1 to 88.5</td><td></td><td>-</td></t<></td></t<>	0.06	0.05 <t< td=""><td>28.1 to 88.5</td><td></td><td>-</td></t<>	28.1 to 88.5		-
Acenaphthene	mg.kg <sup>-1</sup>	0.04<1	0.04<1	0.04<1	0.03<1	0.06	0.18	0.0 to 10.8		l
Acenaphthylene Anthracene	mg.kg 1	0.06	0 18	0.07	0.26	0.19	0.18	31.5 to 33.1 20.5 to 36.5		1
li e	mg kg '		0 64							
Benz(a)anthracene	mg.kg <sup>-1</sup>	0.48		0.68	0 92	0 94	1.60	17.6 to 33.6		
Benzo(b)fluoranthene	mg.kg	1.00	1 00	1.80	1.20	1 40	3.30	36.5 to 58.9		
Benzo(k)fluoranthene	mg.kg <sup>-1</sup>	0.30	0.45	0.43	0.42	0 69	1 10	20.7 to 46.5		
Benzo(g,h,ı)perylene	mg kg <sup>-1</sup>	0.27	0.57	0.23	0.35	0.74	0.82	39.5 to 52.1		
Benzo(a)pyrene	mg.kg	0.55	0.75	0.96	0.82	1.10	2.20	27.2 to 53 1		
Chrysene	mg.kg <sup>-1</sup>	0.80	0.91	1.20	1.00	1.30	2.30	21.3 to 44.4		ŀ
Dibenzo(a,h)anthracene	mg kg	0.08	0.18	0.08	0.14	0.26	0.32	38.2 to 50.9		
Fluoranthene	mg.kg <sup>-1</sup>	1.10	1.80	1.20	1.80	2.10	2.90	25.1 to 27.7		l
Fluorene	mg.kg 1	0.05	0.08	0.05	0.09	0.13	0.11	18.2 to 28.9		
Indeno(1,2,3-cd)pyrene	mg.kg <sup>-1</sup>	0.30	0.62	0.27	0.42	0 78	0.89	35.3 to 48.9		
Naphthalene	mg.kg	0.16	0.19	0.18	0.34	0 70	0.37	17.7 to 42.5		1
Phenanthrene	mg.kg	0.39	0.68	0.40	0.75	0.94	1.00	14.6 to 33.6		1
Рутепе	mg.kg	0.94	1.50	1.10	1.50	1.90	2.50	24.4 to 25 6		1
D <sub>10</sub> -Acenaphthene recovery	%	76	59	79	64	68	60	<b></b>	-	1
D <sub>12</sub> -Chrysene recovery	%	86	98	104	75	104	125			
D <sub>8</sub> -Naphthalene recovery	%	42	26	45	38	28	17		-	
D <sub>12</sub> -Perylene recovery	%	90	119	99	76	130	140			
D <sub>10</sub> -Phenanthrene recovery	%	92	75	86	84	87	88			
	<u></u>	l								

NOTES: "CV" = coefficient of variation [(Std\_Dev./Mean)\*100].

<sup>\*</sup> data from Sturgis (1987).

<sup>\*</sup> data from Storgis (1987).

"<T" = a measurable trace amount; interpret with caution.

"<W" = no measurable response (zero); less than reported value.

"--" not available or could not be calculated.

**Sediment parameter correlation coefficients.** Pearson Product-Moment analysis on  $\log (x+1)$ -transformed concentration data; percentages were arc  $\sin \sqrt{x}$ -transformed. Significant correlations at p < 0.05 are underlined (n = 16). Table A-9.

	_																						
	Dist	Fines	Moist	101	TOC	TP	TKN	As	PD	ئ	٦	CN	Fe	Pb	Mn	Ng	Hg	Z	Zn	SolExt	Ace	Acny	Anth
Dist	100	0 24		0.55	0.31	-027	, 04	6970 6	ତ କୁ	30 024		0 40	0.38	0 40	0.30	0 07	0 20	0.34	0.44	0.38	0.38	0.10	0.35
Fines	0 24	1.00	0.74	0.58	60 0	-0.37	7 0.80			10 8:	0 0.28		0 03	0 27	0 08	0 26	0 18	0 18	0.25	0.26	0 11	0.29	0.11
Moist	0.58	0.74		0.88	0 40	-0.31	98 0		<u>16</u> 0.52			0.81	0.45	0.54	0 39	0 14	0 45	0 43	0.56	0.30	0.56	0.59	0.60
101	0.55	0.58		1 00	0.66	-0 05	5 0.81				7 0.52	0.77	0 49	0.44	0 44	0.12	0.55	96.0	0.52	0 44	0.63	0.64	0.71
TOC	0.31	0.09	0.40	0.66	1 00	0.62			0.05			0.29	0.25	-0 01	0.12	-0 14	0 31	-0.02	60 0	0.71	0.20	0 29	0.38
TL	-0.27	-0 37	Ċ	-0 05	0.62	1.00	1-0.31	•			•	-0.36	-027	-0 49	-0.38	-0.40	-0.02	-0 47	-0 44	0.39	-0.38	-0.24	-0.26
TKN	0 49	0 80	0.86	0.81	0.28	-031	1 00	0 0.81	1 045	5 0 29	9 048	0.71	0.31	0 47	0 32	0.22	0.52	0.35	0 49	0 40	0 49	0.44	0.45
As	69.0	0.58	96.0	78.0	0 40	-0 36	180	1 100	0 061		9 0 E	0.85	0.62	0.61	0.59	0.31	0.45	0.55	99.0	0.26	0 63	0 63	0.72
P.	0 30	028	0.52	0.44	-0 02	-0.53	0.45	5 0.61				0.75	0.88	0.95	0.60	0.75	05.0	0.94	0.96	-0.13	0.48	0.75	6970
r.	024	0 10		0 47	0.25	-0 23			3 0.89			69.0	96 0	0.88	0 93	0.70	95.0	080	0.92	-0 0	0 44	0.85	0 80
రే	0.43	0 28		0.52	0 15	-0 38		_				0.84	0.91	0.92	0.88	Z9 0	0.52	0.93	0.93	900	0.52	0.72	0.71
S	0 40	0.60		0.77	0 29	-0.36				5 0.69		1.00	0.21	0.78	0.69	0.46	090	6970	0.78	0.16	0.53	97.0	0.71
Fe	0.38	0.03		0 49	0 25	-0 27		1 0.62			5 0.91	0.71	1 00	0.88	0.97	0.65	0.55	0.91	0.93	0 01	0.54	0.80	0.93
Pb	0 40	027		0 44	-0 01	0.49			1 0.95		3 0.92	0.78	0.88	1 00	0.86	99 0	0.65	0.92	0.98	-0 05	0 42	0.74	79.0
Mn	0:30	0 08		0 44	0.12	-0 38						0 69	Z6 0	0.86	1 00	27.2	0 47	0.95	0.92	-0 05	75.0	97.0	0.81
Mg	0.07	0.26		0 12	-0.14	-0.40					790 7	0.46	0.65	0.69	0.77	1 00	0 15	0.83	69.0	-0 04	0 13	0 47	0.33
Hg	0 20	0 18		0.55	0 31	-0 05				0,56 0		0.60	0.55	0.65	0.47	0.15	1.00	0.41	0.63	0 19	0.31	0.65	0.58
Z	0 34	0.18		0.36	-0 05	-0.47	0 35					690	0.91	0.92	0.95	0.83	0 41	1.00	0.94	-0.05	0.49	69.0	0.67
Zn	0.44	0.25	0.56	0.52	60 0	-0 44						0.78	0.93	0.98	0.92	69.0	0.63	0.94	1 00	-0.00	0 20	0.77	9.74
SolExt	0.38	0.26	0.30	0 44	0.71	0.39	0.40		·	3 -0 01	90:00	0 16	0 0 1	-0 05	-0.05	-0 04	0 19	-0 05	-0.00	1 00	90 0	-0 12	-0.02
Ace	0.38	0.11	0.56	0.63	0 20	-0.38						0.53	0.54	0 42	75.0	0.13	0.31	0 49	0.50	90.0	1 00	0.55	67.0
Acny	0.10	0 29	0.59	0.64	0 29	-0 24					27.0	0.78	0.80	0.74	0.78	0 47	59 0	69.0	0.77	-0 12	0.55	1 00	0.89
Anth	0.35	0.11	0.60	0.71	0.38	-0 56					2 0.21	0.71	0.83	79.0	0.81	0 33	0.58	790	0.74	-0 05	67.0	0.89	1 00
BaAnth	0.30	0 27	0.62	0.20	0 28	-0.32		2 0.74			0.75	0.77	0.83	22.0	0.83	0.50	79.0	0.73	0.82	-0 07	0 65	0.94	0.94
BbFluo	0.20	0 34	0.59	790	0 27	-0 59	0.57		27.0 6	26.0 Z	1770	0.75	0.78	0.75	62.0	0.55	0.70	0.70	0.79	-0 05	0.56	0.94	28.0
BkFlno	0 16	0.38	0.62	790	0 24	-0 59						7770	0.78	77.0	0.80	95.0	69 0	0.73	0.81	-0 07	0.54	0.94	0.85
BghiP	0 12	0 37	0 63	0.69	0.27	-0 27						0.79	0.79	72.0	6Z-0	0.53	0.70	0.71	0.80	-0 04	0.56	0.95	98.0
ВаР	0 16	0 36	09'0	99 0	024	-031						0.79	0.80	0.78	0.82	750	69.0	0.72	0.81	-0.09	0.52	960	28.0
Chry	0.25	0 32	0.61	0 Z0	0 29	-0 31	0.57					0.78	0.81	0.77	0.82	0.54	69.0	0.72	0.81	-0 04	0.60	0.95	0.91
DahAndh	0 1	0 34	0.62	0.64	0 24	-027	0.56					77.0	0.79	0.7B	0.78	0.49	0.71	0.70	0.80	60 0-	0.52	96 0	0.86
Flan	0 40	0.27	0.65	0.74	0.31	-0.37	0.57					0.78	0.83	0.75	0.83	0.45	0.63	0.71	0.80	-0.03	0.71	0.91	967
Fluo	0.34	0 16	99.0	0.80	0.51	-0.15	0.50					0.70	0.70	0.51	Z9.0	0 18	0.54	0.52	0.59	0.13	0.85	0.82	36.0
IndP	0.12	0 35	0.62	79 0	0 28	-024	09.0		0.79		0.73	0.76	0.78	0.75	0.78	0.51	0.71	0.70	0.79	-0 05	0.56	0.94	0.86
Naph	0 25	-0 04	0 45	0.64	0.62	0.12	0 27				_	0.44	0.50	0.30	0.54	0 12	0.31	0 39	0 42	0 28	0.75	0.61	0.77
Phen	0 45	0 20	0.68	27.0	0 38	-0 32	0.55				0.75	0.78	0.93	0.70	0.80	0 34	0.60	0.69	0.77	0 04	0.82	0.86	0.38
Pyr	96.0	0 27	0.64	0.72	0 29	-0 37	0.56	62.0		9 0.83	0.75	0.78	0.84	0.76	0.84	0 48	0.64	0.73	0.92	-0.05	0.70	0.93	96.0
TPAILS	0.40	0.26	79.0	72.0	0 39	-0 59	0.59	0.82	2 0.75	5 0.82	0.75	9.ZB	0.85	0.73	0.83	0 44	0.63	0.70	0.80	0 04	0.72	0.90	76.0
																							1

	DAAMIN	ppring	BKFIBO	Dgnir	Bar	CIII)	DanAiini	11013	LIE	T III	ides:	Lucii		
Dist	030	0 20	0 16	0 12	0 16	0.25	0 11	0 40	0 34	0 12	0.25	0 45	0 36	0 40
Fines	0 27	0 34	0.38	0 37	96 0	0 32	0 34	0 27	0 16	0 35	-0 04	0 20	0 27	0.26
Moist	0.62	0.59	0.62	0.63	09.0	0.61	0.62	0 65	99 0	0.62	0 45	0.68	0.64	290
107	07.0	790	290	0.68	99.0	0.70	0.64	0.74	0.80	290	0.64	0.77	0.72	0.77
T0C	0 28	0 27	0 24	0 27	0 24	0 29	0 24	0 31	0 51	0 28	0.62	0 38	0 29	98
TP	-0 32	-0 59	-0 59	-0 27	-0 31	-0 31	-027	-0 37	-0 15	-0 24	0 12	-0 32	-0 37	-0 59
TKY	0.56	75.0	09 0	090	0.56	0.57	950	75.0	0 20	0.60	0 27	0.55	0.56	0.58
45	0.74	69 0	79.0	0.68	0.69	0.73	0.65	0.81	0.73	0.66	0 20	0.82	62'0	0.82
P.	6Z-0	0.77	0.80	0.81	0.80	0.79	0.80	0.77	0.53	0.79	96 0	0.71	0.79	0.75
ئ	0.84	0.82	0.83	0.84	0.85	0.84	0.84	0.81	0.66	0.83	0.57	0.77	0.83	0.82
- C	0.75	0.71	0.74	0.75	0.74	0.73	0.75	0.74	0.62	0.73	0 46	67.0	0.75	0.75
S	0.77	0.75	0 77	0.79	0.79	0.78	0.77	0.78	07.0	0.76	0.44	0.78	0.78	0.78
Fe	0.83	0.78	0.78	62.0	0.80	0.81	62 0	0.83	0.70	0.78	09 0	0.83	0.84	0.85
Pb	0.77	0.75	27.0	0.77	0.78	0.77	0.78	0.75	0.51	0.75	0.30	0.70	0.76	0.73
Mn	0.83	67.0	0.80	0.79	0.82	0.82	0.78	0.83	Z9 0	0.78	0 54	0.90	0.84	0.83
Ng	0.50	0.55	0.56	0.53	0.57	0.54	0 49	0 45	0 18	0.51	0 12	0 34	0 48	0 44
H	290	0.70	69.0	0.70	69 0	69.0	0.71	0 63	0.54	0.71	0 31	0.50	0.64	0 63
Z	0.73	0.70	0.73	0.71	0.72	0.72	0.70	0.71	0.52	02 0	0 39	0.68	67.0	0.70
Zn	0.82	67.0	0.81	0.80	0.81	0.81	0.80	0.80	0 59	0.79	0 42	0.77	0.82	0.80
SplExt	-0 07	-0 05	-0 07	-0 04	60 0-	-0 04	60 0-	-0 03	0 13	-0 05	0 28	0 04	-0.05	0 0 4
Ace	0 65	0.56	0.54	0 56	0.52	0.50	0.52	0.71	0.85	0.56	0 75	0.82	0.70	0.72
Acny	0.94	0.94	0.94	0.95	96.0	0.95	96.0	0.91	0 82	0.94	0.61	0.86	0.93	0.90
Anth	0.94	0.87	0.85	0.86	0.87	0.91	0.86	96.0	0.95	0.86	0.77	0.98	960	0.97
BaAnth	1 00	0.98	760	960	76.0	0 99	0.95	0.98	0.85	96.0	0.58	0.94	66 0	0 97
BbFluo	0.98	100	0.98	76.0	0.39	0.99	0.96	0.95	0.78	0.97	0.54	78.0	0.96	0.94
BkFluo	76.0	0 98	1 00	66 0	0 99	0.98	0.98	0.92	0.76	0.99	0 49	0.85	0 94	0.91
BghiP	96 0	760	0.99	1 00	66 0	76.0	0.99	0.92	0.78	1 00	0.55	0.86	0 93	0.95
ВаР	0.97	0 99	0 99	0.99	1 00	0.99	0.98	0.94	0.77	0.36	0.52	0.86	0.95	0.93
Chry	0 99	66 0	0.98	76.0	0 99	1 00	96 0	260	0.82	0 97	0.56	0 91	0.98	96 0
DahAnth	0.95	96-0	0.98	0 99	0 96	9670	1.00	0.91	97.0	0.99	0.51	0.84	0.92	0.90
Flan	96 0	0.95	0.92	0.92	0.94	260	0.91	1 00	0.89	0.91	0.63	0.97	1 00	0 99
Fluo	0.85	0.78	0.76	0.78	0.77	0.82	0.76	0.89	1 00	0.78	0.85	0.95	0.88	0.91
IndP	96.0	76.0	66 0	1 00	0.98	Z6.0	0.99	0.91	0.78	1 00	0.55	0.85	0.93	0.9
Naph	0.58	0.54	0.49	0.55	0.52	0.56	0.51	0 63	0.85	0.55	1 00	0.75	0 62	07.0
Phen	0.94	0.87	0.85	0.86	0.86	0.91	0.84	260	0.95	0.85	0.75	1 00	96 0	0.98
Pyr	0.99	96'0	0.94	0.93	0.95	0.98	0.92	1.00	0 88	0.93	0.62	96.0	1 00	0.99
TPAHS	0 97	0 94	0.91	660	0.93	900	0	0000	0.01	0	0	0	0	

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